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WALTON AND HOLMES'S

ARITHMETICS

THIRD BOOK

BY

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SUPERINTENDENT OF SCHOOLS, NEW BRITAIN, CONN.

NEW YORK ·:· CINCINNATI ·:· CHICAGO
AMERICAN BOOK COMPANY

T5.9464
EducT119.08.840

JUN 1 2 1909

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PREFACE

THIS, the Third Book of the Walton & Holmes's series of Arithmetics, is intended for use in the sixth and seventh years in school. Part I is designed for the sixth year and Part II, with its suggested reviews of work of the sixth year (Part I), is designed for the seventh year.

The book is topical in its treatment rather than spiral. Yet in each part a reasonable amount of attention is given to a review and extension of the work in the four fundamental processes as well as in other topics taught in previous years.

In this book no attempt has been made to treat any topic exhaustively or with completeness. It has rather been the aim of the authors to adapt the work in nature, scope, and quantity, and its presentation, to the needs, capacities, and interests of the children of the sixth and seventh years in school.

In Part I, for the sixth year, particular emphasis has been placed upon Common and Decimal Fractions and their business applications. To these special topics a more extended treatment has been given because at this point in his school life the reasoning power of the child should have been so developed that he is prepared for a more careful analysis and appreciation of number relations in the abstract. For this reason he should now be better able to comprehend the significance of fractional relations of all kinds than at an earlier period.

In Part II, for the seventh year, Common and Decimal Fractions are reviewed and extended, but attention is more especially devoted throughout the year to Percentage and its various applications to business transactions, although the treatment given here is not exhaustive. On the contrary, the

authors have taken great care to adjust the work to the abilities of the children of this grade, depending for a final review and more complete treatment of this and other topics that are included in the business side of arithmetic, upon the fourth and final book of the series, which is in a strict sense a Complete Arithmetic.

In the choice of problems and exercises only those have been presented which are practical in character and adapted to the experiences of the child as well as to his age and ability to comprehend. As this is purely an arithmetic text and nothing else, no attempt has been made to introduce an undue amount of novelty in the nature of the problems given, in the belief that the aim should be to arouse and keep alive the pupil's interest in the subject of arithmetic rather than in a compound of arithmetic with other subjects.

Again, as in the preparation of Books One and Two, the authors have, in making this book, been placed under great obligation to many of their fellow-teachers for the contribution of material and suggestions of value and importance. They are especially indebted to Mr. John D. Billings, Principal of the Harvard School, Cambridge, to Miss A. J. Meadowcroft, Principal of the Burnham School, Haverhill, and to Miss Gertrude E. Bigelow, of the Rice Training School, Boston. Miss Bigelow, in a critical review of the manuscript, made many suggestions that have led to important changes and additions.

G. A. W.
S. H. H.

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THIRD BOOK

PART I

READING AND WRITING NUMBERS

Numbers without Limit

1. All numbers can be expressed by the following figures:

1 2 3 4 5 6 7 8 9 0

One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Zero.

2. The figures from 1 to 9 are called **significant** figures, to distinguish them from **zero**, 0, which is used merely to fill an otherwise vacant place. The numbers 1 to 9 are called **digits.**

3. The manner of writing numbers by figures is shown in the following table:

TABLE

9th	8th	7th	6th	5th	4th	3d	2d	1st					Names.
Hundred-millions	Ten-millions	Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Units (ones)	Decimal point	Tenths	Hundredths	Thousandths	Place or order.
7	2	5,	3	2	8,	7	8	3	.	3	3	3	Figures.

4. One, ten, hundred, thousand, million, etc., are called **units**, because each is used like a single thing in counting other numbers. Ones are called *units of the first order;* tens, *units of the second order;* hundreds, *units of the third order;* thousands, *units of the fourth order;* and so on.

5. Figures written in the first, or right-hand place of whole numbers, represent *ones*.

Figures written in the second place from the right of whole numbers represent *tens;* thus, 10, 20, 30, 40, 50, 60, 70, 80, 90; written in the third place, they represent *hundreds;* thus, 100, 200, 300, 400, 500, 600, 700, 800, 900; written in the fourth place, they represent *thousands;* thus, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000.

Ones, tens, and hundreds together form a **group**, or **period**, which is read as ones. Thus, 7 hundreds, 8 tens, 3 ones, are read together 783 (ones being understood).

Thousands, tens of thousands, and hundreds of thousands form another group, or period, which is read as thousands.

As 10 hundreds make a thousand, so 10 hundred-thousands make a million, 10 hundred-millions make a billion, and so on.

Again, as 1 tenth of 10 is 1, so

1 tenth of 1 is 1 tenth, written .1,

1 hundredth of 1 is 1 hundredth, written .01,

1 thousandth of 1 is 1 thousandth, written .001, and so on.

Tenths, hundredths, thousandths, etc., are called **decimal fractions** or **decimals.**

6. *The value represented by a figure is made ten times as great by the removal of the figure one place to the left, and one tenth as great by its removal one place to the right.*

Oral Exercise

7. **1.** How many figures are required to write thousands? ten-thousands? hundred-thousands? millions? ten-millions? hundred-millions?

2. What mark is used to separate different groups, or periods, of figures? to separate whole ones and decimals?

Oral and Written Exercise

8. 1. In which place of whole ones is the figure written to express ones? to express tens? hundreds? thousands?

2. Write 3 with enough zeros to express hundreds; in the same way write 5 to express thousands; 7 to express seventy thousands.

3. Write 8 millions. Write 10 thousands.

4. Write as one number, 6 millions, 54 thousands, 47 units.

5. Write 407 millions, 15 thousands, 1 hundred.

6. Write 16 millions, 1 thousand, 96 units.

9. 7. Repeat Art. 6, page 8, then read and fill out the following:

8. One of the 10 equal parts of any whole one is 1 ——.

9. One of the 100 equal parts of any whole one is 1 ——.

10. One of the 1000 equal parts of any whole one is 1 ——.

Dimes, cents, and mills in our currency are decimals of a dollar; thus, 1 dime is 1 tenth, 1 cent is 1 hundredth, 1 mill is 1 thousandth of a dollar.

Tenths are written in the first place at the right of the whole ones, with a point called the **decimal point** between tenths and ones. Hundredths are written in the second place, thousandths in the third place.

Thus, 1 dollar with 2 dimes, 3 cents, 4 mills is written, $1.234. The expression is read, 1 dollar, 23 cents, 4 mills.

1 dollar with 5 cents is written, $1.05; 1 dollar with 6 mills is written, $1.006.

The sign $ stands for dollars; ct. or ¢ stands for cents. Write as one number:

11. 4 dollars 50 cents.

12. 90 dollars 8 cents.

13. 15 dollars 17 cents 5 mills.

14. 200 dollars 60 cents 8 mills.

Oral Exercise

10. To familiarize yourself with the reading and the use of large numbers, read the following statistics: they show the increase of the United States in area and population during 105 years, and in two of her material industries within forty or fifty years.

1. In 1800 the area of the main body of the United States was 827,844 square miles. In 1905 it was 3,088,519 square miles.

2. The population of the United States in 1800 was 5,308,483. In 1850 it was 23,191,876. In 1905 it was 75,994,575.

3. The value of the farms and farm property in the United States in 1850 was $3,967,343,580. In 1890 it was $20,514,001,838, an increase in forty years of $16,546,658,258.

4. The value of the fisheries of the United States in 1850 was $2,824,818. It is now about $60,000,000.

Written Exercise

11. Write in figures the numbers in the following:

1. The number of miles of railways in operation in the United States in 1850 was nine thousand twenty-one. In 1906 it was two hundred twenty-four thousand three hundred sixty-three.

2. The Pennsylvania railway has a mileage of ten thousand six hundred eighty-five miles. The Northwestern has a mileage of nine thousand seventy-three miles.

3. In 1905 the state of New York enrolled 1 million, 300 thousand, 65 pupils in her common schools; Pennsylvania, 200 thousand, 230 pupils in hers. The United States as a whole enrolled 16 million, 256 thousand, 39 pupils.

Reading and Writing Exercise .

12. You are supposed to know the numbers of the chapters in your text-books, and can read the dates written in Roman letters.

Read the following:

1.	I	XI	XXI	LV	XIV	XXXIV
2.	II	XII	XXII	VII	XVII	XXXVII
3.	V	XV	XXV	III	XIII	XXXIII
4.	VI	XVI	XXVI	VIII	XVIII	XXXVIII

13. 5. Tell the number for which each of the following stands:

I, V, X, L, C, D, M.

6. What number is represented by IV? by IX? XL? XC? XXIII? XXIV? LXIX?

Read, supplying the missing words, sum or difference:

7. When a given letter is *preceded* by a letter representing less value than the given letter, the —— of the values of the letters is expressed.

8. When a given letter is *followed* by a letter, or combination of letters, representing equal or less value than the given letter, the —— of the values is expressed.

14. 9. Write the letters representing the numbers from ten to twenty.

10. Write the letters that stand for 8, 9, 11, 14, 26, 29.

11. Write the letters that stand for 19, 24, 28, 34, 35, 38.

12. Write in Roman notation the numbers from 40 to 100.

13. Write in Roman notation 590; 494; 649; 1590; 1905.

14. Write in Roman notation 1492; 1776; 1907.

Oral Exercise

15. 1. Supply the missing number and read, $9 + 5 = \text{——}$.

2. What does the sign + show? What is it called?

3. When two or more numbers, as 2, 5, and 8, are united to form one number, what do we call the result?

4. What do we call the process of uniting numbers to find their sum?

16. In the following, add the tens of the lower number to the upper number, and then add the units of the lower number to the sum; thus, in example 5, *a*, say (or think) 46, 66, 73.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
5.	46	48	58	39	29	38	33	19	68
	27	35	33	26	62	36	49	75	27
6.	46	27	29	28	27	15	36	48	45
	38	39	46	54	35	28	47	39	39
7.	35	34	47	27	18	57	29	46	27
	26	27	26	28	25	19	27	38	39
8.	37	49	24	58	27	67	68	87	46
	54	46	68	45	77	39	58	85	94

17. Illustrative Example. Add 2876, 729, and 5634.

WORK

211 (carryings)
2876
729
5634
9239

EXPLANATION. For convenience, we write the numbers with units of the same order in the same column. We add first the units; thus, 4, 13, 19; we write 9 below the line and add the 1 (ten) with the tens; thus, 1, 4, 6, 13; we write 3 (tens) below the line and add the hundreds; thus, 1, 7, 14, 22; and so on.

We write the carryings above the column to which we add them.

Written Exercise

18. Add the following from the bottom upward, and prove the work by adding downward:

1.	2.	3.	4.	5.	6.
1036	40	2.47	$579.80	$4.63	$50.64
908	900	6.21	112.13	9.10	18.05
1684	267	.72	9.97	70.00	44.65
99	168	.63	745.82	83.83	49.17
423	414	9.75	530.00	1.00	0.78

7.	8.	9.	10.	11.	12.
.363	284	56	$15.78	$85.50	$45.50
.407	6,956	927	4.63	67.50	108.95
.098	11,514	6529	0.27	75.00	1056.00
.536	3,709	7892	20.34	50.00	157.60
.647	781	389	1.50	48.75	9.86

13. Add 406, 275, 363, 159, 612, 244, 563, 678.

14. Add 46, 728, 437, 873, 6398, 758.

15. In 8 months an ocean steamer consumed coal as follows: 10,800 tons, 11,380 tons, 12,003 tons, 9130 tons, 10,057 tons, 11,213 tons, 12,512 tons, 10,023 tons. How much did it consume in all?

Write in columns, add, and prove:

16. 1876, 1964, 2129, 2648, 3739, 5850, 4927, 2568, 9436, 3436.

17. $39.24, $486.40, $904.88, $80.65, $386.82, $75.58.

18. 3090; 600,050; 9009; 53,676; 989; 39,029.

19. $787.25, $900.25, $6.14, $5.83, $9964.75.

20. $779.29, $928.07, $54.66, $91.10, $2467.17, $746.93.

21. $80.60, $900, $2060.06, $49.02, $28, $160,160.16.

Oral or Written Exercise

19. Add the following numbers in groups; thus, adding example 1, say (or think), 8, 17, 24, 31.

1.	2.	3.	4.	5.	6.	7.	8.
2	2	1	2	3	1	3	2
5	6	6	4	4	5	5	8
3	1	1	1	2	3	3	3
4	7	1	6	7	4	2	1
2	4	2	1	1	3	2	5
7	5	3	8	5	3	6	2
3	1	2	3	4	2	1	4
5	2	5	7	2	4	3	3

9.	10.	11.	12.	13.	14.	15.	16.
3	6	5	5	8	4	7	7
7	4	1	4	1	3	1	3
4	5	1	8	8	4	4	5
3	5	9	1	2	4	5	5
2	6	7	3	5	2	3	3
5	1	3	6	3	2	3	6
4	6	3	7	4	9	5	2
1	3	1	2	6	1	3	3
6	2	5	6	6	1	5	4
3	8	3	2	4	4	1	4

17.	18.	19.	20.	21.	22.	23.	24.
7	2	5	5	9	8	9	7
2	8	5	6	2	2	2	3
9	7	3	2	4	7	8	9
2	4	8	8	5	4	3	2
7	4	6	4	3	6	6	5
3	3	3	7	8	5	4	5

Oral and Written Exercise

20. In the following add both columns at once; thus, in example 1, say (or think), 12, 22, 33, 43, 52.

1.	2.	3.	4.	5.	6.	7.	8.
9	11	9	11	8	8	7	8
10	7	11	5	6	9	11	4
5	11	5	6	14	22	10	7
6	10	7	11	11	11	2	10
10	6	10	10	6	11	9	11
7	11	3	7	5	6	9	7
5	4	8	10	10	8	7	12

Add the following by groups, when possible:

9.	10.	11.	12.	13.	14.	15.	16.
11	9	11	10	11	8	12	10
7	9	3	5	6	3	9	6
4	2	8	6	4	9	2	4
4	8	7	3	10	2	8	2
6	3	3	7	5	8	2	9
4	3	8	1	2	5	4	8
9	9	6	10	3	15	8	5

Copy and add the following in columns and in lines:

	17.	18.	19.	20.	21.	22.	23.	24.
25.	2+	8+	5+	10+	9+	7+	1+	5=
26.	2+	2+	2+	1+	2+	4+	10+	6=
27.	4+	1+	3+	8+	4+	8+	8+	3=
28.	6+	10+	7+	1+	6+	3+	2+	4=
29.	4+	3+	5+	1+	10+	6+	9+	5=
30.	8+	9+	8+	9+	2+	10+	6+	15=
31.	+_	+_	+_	+_	+_	+_	+_	=_

Written Exercise

21. Add by grouping when possible :

1.	2.	3.	4.	5.	6.	7.	8.
7	5	6	6	2	9	4	4
7	8	8	6	2	3	4	9
2	5	9	5	7	8	6	3
9	5	3	9	9	3	4	9
7	9	4	10	5	10	1	5
3	2	3	1	6	5	10	6
8	7	4	3	7	7	2	8
4	5	7	8	4	6	10	4
5	9	8	7	6	8	9	9
8	6	8	10	15	17	18	5

9.	10.	11.	12.	13.
665 (carryings)	$62.83	$74.73	$9.98	3484
7889	9.89	56.96	4.76	9738
534	9.73	9.98	94.68	9849
5882	82.83	2.92	9.97	2283
469	74.84	91.44	13.97	8453
7676	9.35	5.77	76.25	8858
577	9.27	43.72	5.95	2579
9664	95.87	9.74	76.99	3872
795	8.79	2.99	66.46	5959
685	29.33	98.65	76.89	9988

14. Add $5728.94; $8765; $9638.71; $4987.29.

15. Add $6473.54; $89,320.78; $9467; $824.

16. Add $39,624.96; $78,764.21; $98.64; $7029; $57.645; $27.548; $924.56.

Written Exercise

22. 1. An automobile was run from Boston to South Framingham, a distance of 22 miles, in 48 minutes; thence to Worcester, 23 miles, in 46 minutes; thence to Springfield, 54 miles, in 116 minutes; thence to Pittsfield, 52 miles, in 119 minutes; thence to Albany, 50 miles, in 107 minutes. Find the distance run from Boston to Albany. How many minutes did it take the automobile to run this distance?

2. The area of the New England States is 66,424 square miles; of New York, 49,204 square miles; and of Pennsylvania, 45,126 square miles. Added together the sum is 105,142 square miles less than the area of Texas. How many square miles has Texas?

3. Mr. Fenn bought a farm for $3785. After spending $2978 for new buildings, he sold out at a gain of $737. For how much did he sell?

4. The following is the number of immigrants into the United States for the year ending June 30, 1905, with the customs districts through which they entered. Find the total.

Districts	Immigrants	Districts	Immigrants
New York	788,239	San Francisco	6,955
Baltimore	62,314	Other U. S. Ports	36,577
Boston	65,111	Canadian Ports	44,401

5. The reported occupations of the immigrants arriving during the year 1904, were as follows: unclassed laborers 210,426, servants 104,937, farm laborers 85,850, tailors 23,580, merchants and dealers 19,848, carpenters 13,404, shoemakers 10,567, clerks 10,420, mariners 10,320, miners 9110, professionals (teachers, musicians, etc.) 140,270, unskilled mechanics and laborers 214,692, including children over 14 years old. What was the total number of immigrants?

Oral Exercise

23. 1. Supply the missing number and read, $14 - 8 = \text{——}$.

2. What does the sign $-$ show? What is the sign called?

3. What name is given to the process of taking part of a number away to find how many are left?

4. What do we call the number of which a part is taken?

5. What name is given to the part taken?

6. What name is given to the part that is left?

7. In $14 - 9 = 5$, which is the minuend? the subtrahend?

24. In the following, subtract the tens of the smaller number from the larger number and then subtract the units of the smaller number from the remainder; thus, in example 8 *a*, say (or think) 42, 22, 15.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
8.	42	23	53	33	44	64	54	65	75
	27	14	18	17	16	25	25	38	46
9.	66	76	66	57	84	57	98	93	83
	27	49	29	38	48	39	69	47	45

25. Illustrative Example. Mr. Otis is 65 years old. His wife is 57. What is the difference of their ages?

We find the difference of two numbers by taking away a part of the larger number equal to the smaller, that is, by subtracting.

Find the difference between:

10. 23 ft. and 14 ft.

11. 53 yd. and 38 yd.

12. 64 rd. and 49 rd.

13. \$55 and \$19

14. 64 lb. and 39 lb.

15. 47 yr. and 18 yr.

16. 63¢ and 35¢

17. 95 qt. and 68 qt.

Written Exercise

26. Illustrative Example. From 790 subtract 576.

Work	Proof
790	576
576	214
214	790

Explanation. For convenience we write the numbers with units of the same order in the same column. We begin with units of the lowest order to subtract. Since in the minuend there are no ones, we think of 1 of the 9 tens as changed to 10 ones; 6 from 10 leaves 4; we write 4 below the line. 7 (tens) from 8 (tens), which remain, leaves 1 (ten); we write 1 (ten) at the left of 4. 5(00) from 7(00) leaves 2(00); we write 2 (hundreds) at the left of 1. The remainder is 214. *Ans.* 214.

In practice we may think 6 and **4** = 10, and write 4; 7 and **1** = 8, and write 1; 4 and **3** = 7, and write 3.

Proof. The parts, the subtrahend and remainder, added should equal the minuend. 214 + 576 = 790.

Subtract and prove the following:

	a	*b*	*c*	*d*	*e*	*f*
1.	1181	1292	1232	1182	1192	1270
	773	668	715	343	409	937
2.	1180	1673	1626	1474	1575	1440
	428	958	958	807	907	516
3.	$16.18	$16.10	1528	$13.20	1530	1787
	9.23	8.91	752	9.73	664	899
4.	$17.97	$18.68	$18.26	$135.10	2357	$33.41
	9.68	8.92	8.92	98.91	475	23.75
5.	$26.62	$23.68	2241	1623	1676	$35.44
	23.76	4.74	2098	919	958	17.35

Oral and Written Exercise

27. Find the difference in degrees (°):

1. Water freezes at 32° Fahrenheit, olive oil at 50°.
2. Water boils at 212°, alcohol at 167°, ether at 96°.
3. Iron fuses (melts) at 2800°, lead at 617°, tin at 442°.
4. What is the difference in pounds between the long ton of 2240 pounds and the short ton of 2000 pounds?

The following shows the price of a single ticket at a railroad office and the money offered by a purchaser. How much change should he receive?

	Price	Money		Price	Money		Price	Money
5.	$0.17	$0.50	9.	$1.68	$ 2.00	13.	$3.20	$ 5.00
6.	$0.65	$2.00	10.	$2.23	$ 5.00	14.	$6.15	$10.00
7.	$1.70	$5.00	11.	$1.19	$ 1.50	15.	$3.44	$ 4.00
8.	$2.55	$5.00	12.	$7.11	$10.00	16.	$4.30	$10.00

17. A mixed school has 450 girls and 328 boys. How many fewer boys than girls has the school?

18. The Great Salt Lake is 4200 feet above the level of the sea. Lake Superior is 602 feet above the level of the sea. How many feet higher is the Great Salt Lake?

19. The pyramid of Cheops is 451 feet high. Bunker Hill Monument is 221 feet high. How much higher is the pyramid?

20. A balloon is 6000 feet above the earth. How much more than a mile is it? 1 mile = 5280 feet.

21. In 1896 the world's production of gold was $202,000,000. In 1906 it was $400,000,000. What was the increase?

22. The Brooklyn bridge has a length of 6016 feet. The Victoria-Montreal bridge is 9184 feet long. Find the difference.

Written Exercise

28. Subtract:

1. 9275 7090	**4.** 65,917 36,867	**7.** 706,050 615,141	**10.** $7443.01 5687.39
2. 2436 1934	**5.** $18,452 17,908	**8.** 507,286 286,548	**11.** 902,182 892,218
3. $7651 6666	**6.** $56.63 49.45	**9.** $8619.96 5556.53	**12.** 164,091 57,488

13. Mr. Leonard had $22,304. He spent $7648 for a farm and farming tools. How much had he left?

14. Mount Washington is 6279 feet high; it is 2074 feet higher than Mount Vesuvius. How high is Mount Vesuvius?

15. 5280 feet equal 1 mile. How much more than 1 mile high is Mount Washington? Mount Vesuvius is how much less than 1 mile?

16. Columbus discovered America in 1492. How many years was that before the Pilgrims landed in Plymouth, which was in 1620?

The value of the exports of five leading cities of the United States in 1905 and 1906, was as follows. Find the increase for each city; the totals of increase.

17. New York, in 1905, 559,203,393; in 1906, 621,950,530.

18. New Orleans, " 144,352,004; " 167,988,257.

19. Boston, " 93,797,887; " 99,370,016.

20. Galveston, " 150,112,542; " 186,843,998.

21. Baltimore, " 103,607,135; " 107,979,104.

22. Totals.

Written Exercise

29. 1. Mr. Armstrong owes Mr. Bowen $27.56, $908, $74.77, $86.56, and $68.98. Mr. Bowen owes Mr. Armstrong $90.45, $78.80, $67.90, $6.87, and $59.58. Which owes the more? How much more?

2. I pay out for shoes $2.50, for a hat $1.75, for a suit of clothes $14.50, and for books $4.75. How much will be left from a $50 bill?

3. Columbus landed at San Salvador in 1492. The War of the Revolution began in 1775. How many years elapsed between these two dates?

4. A man owed $46.15, $32.76, and $480. He paid $327.29. How much did he still owe?

5. Mr. Smith had $500. He bought a horse for $87 and a carriage for $55. How much had he left?

6. In 1900 New York City had 3,437,202 inhabitants, Chicago had 1,698,575. How many more had New York than Chicago?

7. Mount Marcy, the highest mountain in New York, is 5344 feet high; Mount Mitchell, the highest mountain in North Carolina, is 6711 feet high. Find the difference.

8. Compare the height of each of the above with 1 mile.

9. The distance from New York to Portland, Maine, *via* Boston is 325 miles; the distance from New York to Boston is 217 miles. Find the distance from Boston to Portland.

10. From the sum of 87.59 and 64.87 take their difference.

11. If the distance of the sun from the earth is 92,790,000 miles and the distance of the moon from the earth in the same direction is 238,850 miles, how many miles is it from the moon to the sun?

30. Areas and Population of the New England States

States	Area in Square Miles	Population 1900	Children in Pub. Sch. 1906
Maine	33,040	694,666	130,457
New Hampshire	9,341	411,588	64,413
Vermont	9,564	343,641	64,681
Massachusetts	8,266	2,805,346	508,816
Rhode Island	1,248	428,556	71,425
Connecticut	4,965	908,420	173,973

Areas and Population of the Middle Atlantic States

States	Area in Square Miles	Population 1900	Children in Pub. Sch. 1906
New York	49,204	7,268,894	1,335,554
New Jersey	8,224	1,883,669	369,409
Pennsylvania	45,126	6,302,115	1,229,046
Delaware	2,370	184,735	36,895
Maryland	12,327	1,188,044	227,614
Dist. Columbia	70	278,718	51,230
Virginia	42,627	1,854,184	361,772
W. Virginia	24,170	958,800	255,160

Written Exercise

31. 1. Find the total area of the New England States; of the Middle Atlantic States. Find their difference in area.

2. Find the total population of New England; of the Middle Atlantic States. Find their difference in population.

3. Find the total number of pupils in the public schools of New England; of the Middle Atlantic States.

4. How much greater in extent is New York than Maine?

Oral Exercise

32. 1. Supply the missing number and read, $8 \times 9 = \text{——}$.

2. What does the sign $\times$ show? For what word or words does it stand?

3. When a number of equal numbers, as 12 twos, are united at once to form one number, what is the result called?

4. What is the process of uniting a number of equal numbers to find their product called?

5. What is one of the equal numbers, or the number to be multiplied, called?

6. What is the number we multiply by called?

7. In 8×7 days $= 56$ days, name the multiplicand; the multiplier; the product.

Written Exercise

33. Illustrative Example. Multiply 345 by 12.

Work	Proof
345	12
12	345
4140	4140

Explanation: 12×5 (units) $= 60$; $60 = 6$ (tens) and no (units). We write 0 below the line and reserve the 6 (tens). 12×4 (tens) $= 48$ (tens), with the 6 (tens) reserved, $= 54$ (tens). We write 4 (tens) at the left of 0, and reserve the 5 (hundreds). 12×3 (hundreds) $= 36$ (hundreds); 36 (hundreds) with the 5 (hundreds) reserved $= 41$ (hundreds) which we write at the left of 4, and have for the product 4140.

To prove the work multiply the multiplier by the multiplicand.

Multiply and prove:

	a	*b*	*c*	*d*
1.	2368×3	3598×8	$\$35.68 \times 11$	$\$6243.60 \times 10$
2.	6838×9	7529×6	$\$28.06 \times 11$	$\$54.965 \times 11$
3.	7435×7	7065×5	$\$37.98 \times 12$	$\$43.578 \times 12$

Written Exercise

34. Illustrative Example. Multiply (1) 432 by 110; (2) $4.32 by 220.

WORK

(1) 432 multiplicand
110 multiplier
4320 prod. by 10
43200 prod. by 100
47520 prod. by 110

EXPLANATION. (1) The multiplication of 432 by 10 is expressed by annexing a zero to 432, thus, 4320; the multiplication by 100 is expressed by annexing 2 zeros to 432, thus, 43,200; 4320 + 43,200 = 47,520. *Ans.* 47,520.

In practice the zeros in the product by 100 would be omitted.

(2) $4.32
220
86.40 prod. by 20
864.00 prod. by 200
$950.40 prod. by 220

(2) The multiplication of $4.32 by 20 is expressed by moving the decimal point 1 place to the right and multiplying by 2, result, $86.40; the multiplication by 200 is expressed by moving the decimal point 2 places to the right, and multiplying by 2, result, $864.00. $86.40 + $864.00 = $950.40.

Ans. $950.40.

When the multiplier is a number of 10's, 100's, *etc., multiply by the number of* 10's, 100's, *etc., and annex to the figures of the product as many zeros as the multiplier has zeros at the right.*

If there is a decimal point in the figures of the multiplicand, move it one place to the right when the multiplier is 10's, *two places to the right when the multiplier is* 100's, *and so on.*

Copy, and multiply:

1. 423 × 110
2. 834 × 22
3. $51.20 × 44
4. $318.70 × 114
5. $4.23 × 370
6. $5.68 × 52
7. $72.50 × 15
8. $61.10 × 150

Written Exercise

35. 1. Della earns $4.62 a week. How much is that for a year of 52 weeks?

2. A walk 100 feet long 8 feet wide contains how many square feet? $100 \times 8 = ?$ *

3. At 56 pounds to a bushel, how many pounds of shelled corn are there in 4 bins which contain, severally, 36 bushels, 57 bushels, 29 bushels, and 68 bushels?

4. Find the cost of 13 linen suits at $12.50 each.

5. What must be paid for 25 cords of wood at $8.50 a cord?

6. What will be the cost of 260 pounds of copper at 28¢ a pound?

7. A seamstress who receives $8.50 a week works the year round excepting 4 weeks. How much are her yearly wages?

8. The first House of Representatives of the United States consisted of 65 members. If each member represented 30,000 people, how many people were represented?

9. In a certain mill 139,300 yards of dress goods are made in a day. How much is that in 6 days?

10. In one yard of a particular kind of cloth there are 590 fibers of warp. If each fiber contains 32 strands, how many strands are there in the yard?

	a	*b*	*c*	*d*
11.	658×63	439×168	$\$12.50 \times 123$	$\$97.08 \times 905$
12.	658×185	394×246	$\$6.84 \times 234$	$\$22.80 \times 578$
13.	197×297	526×475	$\$37.50 \times 167$	$\$33.17 \times 294$

* It is assumed that the pupil knows the units of linear and of square measure and has learned to find rectangular areas by multiplying together like units of length and width.

Written Exercise

36. **1.** The floor of a horse stall is 9 feet long and 6 feet wide. Give its area. $9 \times 6 = ?$

2. Multiply \$11.46 by 28 and prove the work.

3. A dealer bought 68 horses at \$256 each. How much did he pay for them?

4. If a baker makes 400 dozen crackers a day, how many will he make in 300 days?

5. In 18 days of 8 hours each, how much can a man earn at 30 cents per hour?

6. What change will be received from \$100 in payment for 25 yards of silk at \$1.65 a yard and 8 yards of broadcloth at \$2.70 a yard?

7. What is the value of 95 cases of shoes, each case having 24 pairs worth \$1.75 a pair?

8. A hall floor is 28 yards long and 16 yards wide. How many square yards does it contain? how many square feet? 1 yard = 9 square feet.

9. How much will it cost to lay a floor in a room 12 yards long, 8 yards wide, at \$1.15 per square yard?

10. How many quart cans can be filled with $28\frac{1}{2}$ gallons of milk?

11. How much will it cost to plow a field 132 feet long, 112 feet wide, at $3\frac{1}{4}$¢ a square foot?

12. Multiply 40,129 by 9008.

13. A stationer bought 136 dozen Christmas cards at 25¢ per dozen. He sold them at the rate of 2 cards for 5¢. Did he gain or lose? How much?

PROBLEMS

Written Exercise

37. **1.** The stock of cotton in the New York market August 8, 1906, was 94,710 bales, weighing an average of 450 pounds to the bale. Find its value at 10.7 ¢ per pound.

NEW YORK, Thursday, Aug. 7, 1906.

The receipts yesterday at the cotton ports were 7093 bales. Thus far this week, 17,482 bales; same time last week, 24,113 bales. Exports thus far this week, 6944 bales; same time last week, 39,910 bales. Stock at ports, 212,958 bales; same time previous week, 206,107 bales; last year, 369,472 bales.

2. Find the difference in the receipts above for the three days preceding Aug. 7, 1906, and the receipts for the corresponding days of the week before.

3. In the same way find the difference in exports.

4. Find the difference in the stock at port.

5. A cotton mill with a weekly pay roll of $2500 advances the pay of all its operatives 10 cents on a dollar. What is the total weekly increase? the total weekly pay roll after the advance? the yearly increase? the yearly pay roll before and after the advance?

BOSTON, Aug. 7, 1906.

The exports of leather for the week were valued at $174,603; preceding week, $287,369; same week last year, $166,992. Since Jan. 1 the total exports have been $6,531,852; same time in 1905, $5,483,801; increase, $———.

6. What was the difference in the value of the exports of leather for the week ending Aug. 7, 1906, and for the preceding week?

7. Make other problems from the above.

38. 1. Supply the missing number and read the following: $28 \div 4 = \text{——}$.

2. What does the sign $\div$ show? For what words does it stand?

3. What do we call the process of finding how many times one number is contained in another?

4. What is the number to be divided called? the number we divide by?

5. What name is given to the result of the division?

6. In $28 \div 4$, name the quotient; the dividend; the divisor.

Written Exercise

39. Illustrative Example. (1) Divide \$680 by \$2. (2) Divide \$680 between two men.

WORK

divisor

340 quotient
$2\overline{)680}$ dividend

PROOF

$340 \times 2 = 680$

EXPLANATION. (1) To divide \$680 by \$2 is to find how many times \$2 is contained in \$680: 2 is contained in 6 hundred 3(00) times; we write 3 (hundreds) in the quotient. 2 is contained in 8 tens 4(0) times; we write 4 (tens) in the quotient. 2 is contained in no (units) no times; we write 0 in the quotient. *Ans.* 340.

(2) If we divide \$680 between 2 men, each man will have 1 half of \$680. 1 half of 6 (hundreds) is 3(00); we write 3 (hundreds) in the quotient. 1 half of 8 (tens) is 4(0); we write 4 (tens) in the quotient. 1 half of no (units) is no units; we write 0 in the quotient. The entire quotient is 340. *Ans.* \$340.

Divide; prove by multiplying the quotient by the divisor:

1. \$690 ÷ \$8
2. \$963 ÷ \$3
3. \$1280 ÷ \$4
4. \$1836 ÷ \$6
5. \$3078 ÷ \$6
6. $8\overline{)3224}$
7. $7\overline{)5634}$
8. $2\overline{)47,380}$
9. $3\overline{)90,147}$
10. $4\overline{)76,800}$
11. $3\overline{)17,766}$
12. $5\overline{)336,540}$
13. $8\overline{)180,064}$
14. $7\overline{)861,350}$
15. $5\overline{)607,595}$
16. \$38,076 ÷ 4
17. \$8,464.40 ÷ 8
18. \$9,660 ÷ 7
19. \$45,842 ÷ 9
20. \$631.44 ÷ 9

40. When the divisor is small and we know its products, we can divide without writing down the work. The process is then called **short division.**

The examples on page 29 are done by short division.

41. When the divisor is large and we have to find its products as we divide, it is convenient to write down the work. When the work is written down, the process is called **long division.**

The illustrative examples below are done by long division.

Written Exercise

42. Illustrative Example. (1) Divide 19,034 by 62; (2) by 621.

WORK

(1)
$$\begin{array}{r} 307 \\ 62\overline{)19034} \\ \underline{186} \\ 434 \\ 434 \end{array}$$

EXPLANATION. (1) 62 is not contained in 1 ten thousand any ten thousand times, nor in 19 thousands any thousand times. It is contained in 190 hundreds 3 (hundred) times with (4 hundreds) undivided; 4 (hundreds) united with the 3 (tens) = 43 (tens); 62 is contained in 43 (tens) no (tens) times with 43 (tens) undivided; we write 0 (tens) in the quotient. 43 tens united with 4 = 434; 62 is contained in 434, 7 times; we write 7 in the quotient. *Ans.* 307.

(2)
$$\begin{array}{r} 30 \\ 621\overline{)19034} - 404 \\ \underline{1863} \\ \text{Remainder } 404 \end{array}$$

(2) Briefly 621 is contained in 1903 (tens) 3 (tens) times with 40 (tens) undivided; 40 (tens) united with 4 units = 404; 621 is contained in 404 no times with 404 undivided.

Ans. Quotient 30. *Remainder* 404

In the work of (2) above read 1863 as tens; as units. In the work of (1) above read 186 as units; as tens; as hundreds.

Divide and prove; in proving, if there is a remainder, add it to the product of the divisor and quotient.

1. 846 by 18
2. 1512 by 27
3. $805 \div 23$
4. $1225 \div 49$
5. $33{,}590 \div 82$
6. $59{,}885 \div 82$
7. $174\overline{)7830}$
8. $329\overline{)5264}$

Written Exercise

43. Illustrative Example. $3380 of profits is divided equally among 65 shares of stock in a gold mine. Find how much each share receives.

SOLUTION. Each share receives $\frac{1}{65}$ of $3380; $\frac{1}{65}$ of $3380 is $52. Hence each share receives $52.

1. If 92 pounds of butter sells for $22.08, what is the price per pound?

2. A train goes 1710 miles in 45 hours. What is the rate per hour?

3. $13.50 is paid for 75 dozen eggs. What is the price per dozen?

4. What is the average weight of 68 firkins of lard if the total weight is 2108 pounds?

5. $74,152 was paid in wages to 92 workmen in one year. What was the average to a workman?

6. When 57 barrels of flour sell for $250.48, what is the price per barrel?

7. If 845 sides of sole leather weigh 23,660 pounds, what is the average weight per side?

8. 671 establishments in the United States engaged in preparing meat for the market employ 62,403 wage-earners. What is the average number to an establishment?

Divide, using either explanation, Art. 39, page 29.

	a	*b*	*c*	*d*
9.	432,700 by 7	200,786 by 8	84,140 by 28	53,769 by 68
10.	651,734 by 5	160,306 by 4	47,533 by 78	54,937 by 68
11.	490,607 by 6	674,830 by 9	40,843 by 47	44,712 by 41

Written Exercise

44. Illustrative Example. Divide (1) 5200 by 100; (2) \$52.66 by 20.

(1) WORK

52 quotient
1|00)52|00

EXPLANATION. (1) To divide 5200 by 100 is to find how many 100's there are in 5200. By cutting off the zeros, we express the division of 5200 by 100. The quotient is 52. *Ans.* 52.

(2)

2.633 quotient
2|0)5.266

(2) The division of \$52.60 by 20 is expressed by moving the decimal point one place to the left and dividing by 2. The quotient is \$2.63. *Ans.* \$2.63.

When the divisor is a number of 10's, 100's, *etc., we cut off as many of the right-hand figures of the dividend as the divisor has zeros at the right, then divide by the number of* 10's, 100's, *etc.*

If there is a decimal point in the figures of the dividend, we move it 1 *place to the left when the divisor is* 10's, 2 *places to the left when the divisor is* 100's, *and so on.*

Divide:

	a	*b*	*c*	*d*
1.	720 by 60	3600 by 100	12,100 by 1100	\$320 by 40
2.	540 by 90	3600 by 120	10,800 by 900	\$34.40 by 80
3.	880 by 10	8880 by 10	\$45.50 by 50	\$930 by 300
4.	630 by 70	7200 by 600	\$85.40 by 70	\$102.20 by 70

5. How many bushels of corn at 80¢ a bushel will \$156.80 buy?

6. How many steps, each 30 in., are there in $\frac{1}{4}$ mi.?

7. How many \$100 bills will pay a debt of \$7000?

8. Divide the expense of a picnic, \$19.60, among 40 persons.

Written Exercise

45. 1. In a corn field there are 5760 hills of corn. If there are 60 hills in a row, how many rows are there?

2. A man has 1980 pounds of butter which he wishes to put into 20-pound boxes. How many boxes will it take?

3. How many tons of coal at $7.50 a ton can be bought for $2062.50?

4. How many dozen eggs at 20¢ a dozen will $106 buy?

5. A cord of wood 8 feet long, 4 feet wide, and 4 feet high contains how many cubic feet? $8 \times 4 \times 4 = ?$ *

6. A woodshed 80 feet long, 20 feet wide, and 10 feet high contains how many cubic feet? How many cords of wood can be packed into this shed? $(80 \times 20 \times 10) \div 128 = ?$

7. How many cords of wood are there in 100 piles each 16 feet long, 8 feet wide, and 4 feet high? $(100 \times 16 \times 8 \times 4) \div 128$.

8. A man gave to his wife $15,800, and to each of his children $\frac{1}{10}$ as much. How much did he give each child?

9. What should be given for 25 tons of coal if 200 tons cost $1750?

10. What is the cost of 280 quarts of cherries at 8 cents a quart?

11. How much will one ton of Russia colored calfskins cost at 23¢ a pound?

12. Find the cost of a cablegram of 5 words to Burmah at $1.37 a word; of 12 words to Japan at $2.21 a word, and 7 words to Siam at $1.43 a word.

* The footnote, page 26, applies equally to cubic measure, and the finding of cubical contents by multiplying together like units of length, breadth, and thickness.

Written Exercise

46. 1. I paid $120 for a watch, $\frac{3}{10}$ as much for a chain. How much did I pay for the chain?

2. 1 ton of hay costs $15. How many tons can be bought for $2175?

3. At 7¢ a pound for sugar, how many pounds can be bought for $14.56?

4. If 27 acres of land cost $2015, how much will 65 acres cost?

5. Tea is 80¢ a pound. How many pounds will $29.36 buy?

The following wholesale provision prices were published July 30, 1906:

Flour is dull and lower; spring patents $4.40 to $4.50 per bbl., winter patents $4 to $4.25.

Cheese is quiet, but firm; York State 11¢ to 12¢.

Eggs are firm; choice hennery and near-by 25¢ to 27¢.

Potatoes are easy at $1.50 to $2.25 per bbl. for white. Sweets are easy at $3 to $3.50 for white, and $3.50 to $4 for yellow North Carolina.

Using the above price list and selecting your own prices, perform the following examples:

6. What is the cost of 1 ton of York State cheese at 11 cents per pound? at 12 cents per pound?

7. What is the cost of 800 bbl. of potatoes at $1.75 per barrel? at $2.20 per barrel?

8. How much more will 1000 dozen choice hennery eggs cost at 26¢ a dozen than 1000 dozen Western eggs at 19¢?

9. Find the cost of 50 bbl. of spring patent flour, at $4.40 per barrel, and 50 bbl. of winter patent at $4.10 per barrel. Find the difference in the cost of the two lots.

Make up a variety of questions upon the list given above.

Oral Exercise

47. 1. Name two numbers which multiplied together make 10; 11.

Whole numbers which multiplied together make a number are called **factors** of the number which they make.

48. A number, like 11, that has no factors but itself and 1 is called a **prime number.**

49. A number, like 10, that has other factors besides itself and 1 is called a **composite number.**

50. Because the prime numbers 5 and 2 multiplied together make 10, they are called the **prime factors** of 10.

2. Name all the prime numbers from 2 to 40; the composite numbers.

51. Illustrative Example. Find the prime factors of 36.

WORK

$$\begin{array}{r|l} 2 & 36 \\ 2 & 18 \\ 3 & 9 \\ \hline & 3 \end{array}$$

EXPLANATION. Dividing 36 by the prime number 2, we get the quotient 18; dividing 18 by 2, we get the quotient 9; dividing 9 by the prime number 3, we get the quotient 3, and thus find that the prime factors of 36 are 2, 2, 3, and 3, *i.e.* $2 \times 2 \times 3 \times 3 = 36$.

From the example above, we learn that,

To separate a number into its prime factors, we first divide the given number by one of its prime factors. We then divide the quotient thus obtained, by one of its prime factors, and so continue dividing until a quotient is obtained that is a prime number.

This quotient and the several divisors are the prime factors sought.

Oral and Written Exercise

52. The following are tests by which we can tell at sight some of the prime factors of a number:

(1) 2 is a factor of a number if its units' figure is 0, 2, 4, 6, or 8.

(2) 5 is a factor of a number if its units' figure is 0 or 5.

(3) 3 is a factor of a number if 3 exactly divides the sum of its digits.

Find the prime factors of

1.	2.	3.	4.	5.	6.	7.	8.
30	45	28	32	54	48	96	102
42	60	40	55	72	56	100	132

9. Name a factor of 8 which is also a factor of 12.

10. Name the largest factor common to both 8 and 12.

Because 4 is the largest factor common to 8 and 12, it is called the **greatest common factor** of 8 and 12.

We write g. c. f. for greatest common factor.

53. Illustrative Example. Find the g. c. f. of 12 and 18.

WORK

$12 = 2 \times 2 \times 3$
$18 = 2 \times 3 \times 3$
g.c.f. $2 \times 3 = 6$

EXPLANATION. Separating 12 and 18 into their prime factors, we see that 2 and 3 are prime factors of both 12 and 18. Since they are the only prime factors that are common to 12 and 18, their product must be the greatest common factor.

Find the greatest common factor:

1. Of 16 and 20
2. Of 42 and 35
3. Of 20 and 30
4. Of 24 and 36
5. Of 56 and 16
6. Of 54 and 24

Oral and Written Exercise

54. Illustrative Example. Divide $6 \times 12 \times 9$ by 3×4.

WORK

$$\frac{6 \times \cancel{12} \times 9}{\cancel{3} \times \cancel{4}} = 54$$

EXPLANATION. To divide we write the dividend, $6 \times 12 \times 9$, above a line, and the divisor, 3×4, below it. When a number or the product of two or more numbers is to be divided by another number or by the product of two or more numbers, factors that are common to dividend and divisor may be struck out. Hence, in multiplying and dividing a number by numbers that have common factors, such factors may be struck out.

55. Striking out common factors is called **canceling.**

Divide:

1. $8 \times 14 \times 5$ by 7
2. $30 \times 5 \times 8$ by 15×4
3. $4 \times 44 \times 9$ by 33×8
4. $50 \times 16 \times 3$ by 10×24
5. $48 \times 3 \times 5$ by 12×40
6. $52 \times 34 \times 12$ by 13×8

MULTIPLES

56. A number made by using another number as a factor is called a **multiple** of the number so used. Thus, the numbers 2, 4, 6, and 8 are all multiples of 2.

1. Name the multiples of 5 from 5 to 50.

57. Illustrative Example. Name some numbers that are multiples of both 3 and 4.

The multiples of 3 are 3, 6, 9, **12**, 15, 18, 21, **24**, 27, etc.

The multiples of 4 are 4, 8, **12**, 16, 20, **24**, 28, etc.

12 and **24** are multiples of both 3 and 4.

58. A number that is a multiple of two or more numbers is called a **common multiple** of the numbers.

59. The least number that is a multiple of two or more numbers is called their **least common multiple.**

2. Name the least common multiple of 3 and 4; of 6 and 4.

Oral Exercise

60. 1. Find the l. c. m. of 6 and 5. 3. The l. c. m. of 6 and 9.

2. Find the l. c. m. of 8 and 6. 4. The l. c. m. of 10 and 15.

61. The least common multiple of two or more numbers is *the least number that contains all the factors of all the numbers.*

We write l. c. m. for the least common multiple.

Written Exercise

62. Illustrative Example. Find the l. c. m. of 9, 12, and 18.

WORK

$9 = 3 \times 3$

$12 = 2 \times 2 \times 3$

$18 = 2 \times 3 \times 3$

l. c. m. $= 3 \times 3 \times 2 \times 2 = 36$

SOLUTION. To contain 9, the l. c. m. must contain the factors 3 and 3, which we write. To contain 12, it must contain the factors 2, 2, and 3. We have a 3, so we only write 2 and 2. The factors of 18 we already have. Therefore, the l. c. m. equals $3 \times 3 \times 2 \times 2$, or 36. *Ans.* 36.

1. Find the l. c. m. of 4, 6, and 9.
2. Find the l. c. m. of 8, 14, and 22.
3. Find the l. c. m. of 10, 12, and 18.
4. Find the l. c. m. of 6, 26, and 39.

63. The following method is recommended, when the l. c. m. of many, or of large numbers is to be found.

3)	9	12	18
3)	3	4	6
2)	1	4	2
		2	1

Here, by repeated divisions, we take out all the factors that are common to two or more of the numbers and thus find all the different factors of the several numbers. The product of these factors (divisors), with the remaining factors, will be the l. c. m. $3 \times 3 \times 2 \times 2 = 36$.

Find the l. c. m.

5. Of 25, 60, 120.
6. Of 32, 42, 80.
7. Of 14, 18, 91.
8. Of 72, 96, 14.
9. Of 21, 56, 70.
10. Of 54, 81, 144.

Oral Exercise

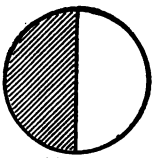


Fig. 1.

64. 1. Into how many equal parts is the circle divided?

2. Into how many equal parts is the oblong Fig. 2 divided? the oblong Fig. 3?

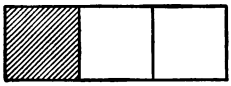


Fig. 2.

3. What name do we give to one of the parts of the circle? to one of the parts in Fig. 2? in Fig. 3? What name do we give to the part not shaded in Fig. 2? in Fig. 3?

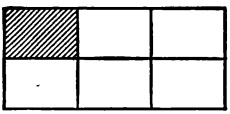


Fig. 3.

4. What name do we give to a single thing, or one, to distinguish it from 1 ten, 1 hundred, 1 thousand, etc.?

65. When a unit is divided, as above, into equal parts, one or more of the equal parts is called a **fraction.**

One half, two thirds, five sixths, are called **common fractions.**

66. We write the common fraction two thirds thus, $\frac{2}{3}$.

67. The number written below the line shows the number of parts into which the unit is divided; it is called the **denominator.**

Denominator means *namer.*

68. The number written above the line shows the number of parts in the fraction; it is called the **numerator.**

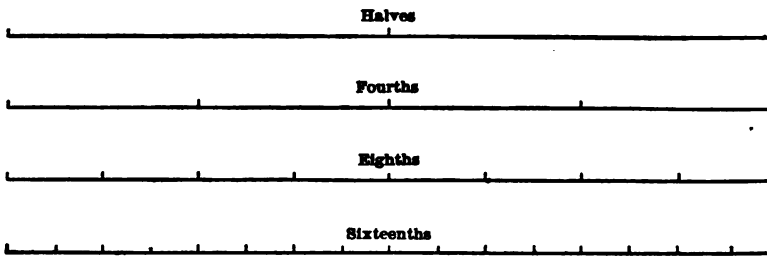
Numerator means *numberer.*

69. The numerator and denominator are the **terms** of the fraction.

5. Name the terms, numerator and denominator, of $\frac{5}{6}$.

6. Name some common fractions, give their terms, and tell what each term shows.

Oral and Written Exercise



70. 1. $\frac{1}{2}$ equals how many 4ths? 8ths? 16ths?

2. $\frac{1}{4}$ equals how many 8ths? 16ths? 1 equals how many 16ths?

71. Illustrative Example. Change $\frac{3}{4}$ to 16ths.

SOLUTION. 1 equals $\frac{16}{16}$; $\frac{1}{4}$ equals 1 fourth of $\frac{16}{16} = \frac{4}{16}$, and $\frac{3}{4}$ equals 3 times $\frac{4}{16}$, $= \frac{12}{16}$. *Ans.* $\frac{12}{16}$.

To change a given fraction to an equivalent fraction in larger terms, we multiply both terms by the same number.

To find the number to multiply the terms of the given fraction by, we divide the denominator of the required fraction by the denominator of the given fraction.

Change the following to equivalent fractions as indicated:

3. $\frac{2}{3} = \frac{\quad}{6} = \frac{\quad}{9} = \frac{\quad}{12} = \frac{\quad}{21} = \frac{\quad}{30} = \frac{\quad}{33} = \frac{\quad}{36}$.

4. $\frac{3}{4} = \frac{\quad}{8} = \frac{\quad}{16} = \frac{\quad}{40} = \frac{\quad}{48} = \frac{\quad}{100} = \frac{\quad}{120}$.

Change

5. $\frac{2}{3}$, $\frac{3}{8}$, $\frac{5}{6}$ to 24ths

6. $\frac{2}{5}$, $\frac{5}{6}$, $\frac{7}{10}$ to 30ths

7. $\frac{2}{9}$, $\frac{5}{12}$, $\frac{2}{3}$ to 36ths

8. $\frac{3}{8}$, $\frac{7}{12}$, $\frac{5}{16}$ to 48ths

9. $\frac{5}{6}$, $\frac{4}{5}$, $\frac{8}{15}$ to 60ths

10. $\frac{3}{7}$, $\frac{2}{3}$, $\frac{5}{6}$ to 42ds

Change

11. $\frac{3}{8}$, $\frac{4}{7}$, $\frac{3}{14}$ to 56ths

12. $\frac{7}{12}$, $\frac{6}{9}$, $\frac{5}{8}$ to 72ds

13. $\frac{3}{20}$, $\frac{3}{4}$, $\frac{9}{25}$ to 100ths

14. $\frac{1}{12}$, $\frac{9}{15}$, $\frac{3}{20}$ to 120ths

15. $\frac{2}{9}$, $\frac{5}{8}$, $\frac{11}{12}$ to 144ths

16. $\frac{7}{10}$, $\frac{8}{15}$, $\frac{13}{30}$ to 150ths

72. A number, as $\$2\frac{1}{2}$, which consists of a whole number and a fraction, is called a **mixed number.**

73. A fraction, as $\frac{1}{2}$, which is less than one, is called a **proper fraction.** A fraction, as $\frac{2}{2}$, or $\frac{5}{2}$, which equals or exceeds one, is called an **improper fraction.**

74. Illustrative Example. Change $18\frac{3}{8}$ to 3ds.

WORK

$18\frac{3}{8} = \frac{54}{3}$

3

56

SOLUTION. In 1 whole one there are $\frac{3}{3}$; in 18, there are 18 times $\frac{3}{3}$, which, with $\frac{3}{3}$ added $= \frac{57}{3}$. *Ans.* $\frac{57}{3}$.

EXPLANATION. In practice it is usually easier to multiply the whole number by the denominator. Hence,

To change a whole or a mixed number to an equivalent improper fraction, we multiply the whole number by the given denominator, add the numerator if there is one, and write the result over the given denominator.

Oral and Written Exercise

75. Change the following to improper fractions:

	a	*b*	*c*	*d*	*e*	*f*
1.	$2\frac{3}{4}$	$5\frac{3}{5}$	$11\frac{1}{3}$	$30\frac{1}{4}$	$100\frac{7}{8}$	$704\frac{11}{12}$
2.	$8\frac{1}{3}$	$7\frac{7}{8}$	$10\frac{6}{7}$	$69\frac{4}{5}$	$106\frac{5}{7}$	$180\frac{4}{15}$
3.	$9\frac{4}{5}$	$6\frac{5}{9}$	$9\frac{8}{11}$	$70\frac{8}{7}$	$125\frac{9}{10}$	$207\frac{7}{20}$
4.	$7\frac{3}{4}$	$10\frac{8}{11}$	$84\frac{1}{2}$	$86\frac{3}{5}$	$341\frac{3}{9}$	$614\frac{15}{22}$
5.	$6\frac{7}{8}$	$12\frac{9}{10}$	$53\frac{3}{8}$	$77\frac{3}{8}$	$369\frac{5}{6}$	$983\frac{19}{26}$

Oral Exercise

76. Illustrative Example. How many whole ones are there in (1) $\frac{125}{5}$? (2) $\frac{125}{10}$?

WORK

(1) $5\overline{)125}$ 25

(2) $1\,0\overline{)12.5}$ $12.5 = 12\frac{1}{2}$

SOLUTION. (1) $\frac{1}{5}$ = a whole one; $\frac{125}{5}$ = as many whole ones as there are 5's in 125, which is 25. *Ans.* 25.

(2) $\frac{1}{10}$ = a whole one; $\frac{125}{10}$ = as many whole ones as there are 10's in 125, which is 12.5, or $12\frac{1}{2}$. See Art. 44, Ill. Ex. 2. *Ans.* $12\frac{1}{2}$.

Change to equivalent whole or mixed numbers:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1.	$\frac{18}{4}$	$\frac{57}{7}$	$\frac{48}{5}$	$\frac{61}{2}$	$\frac{87}{8}$	$\frac{68}{10}$	$\frac{87}{12}$	$\frac{62}{5}$	$\frac{108}{12}$
2.	$\frac{54}{9}$	$\frac{45}{6}$	$\frac{70}{11}$	$\frac{68}{8}$	$\frac{68}{7}$	$\frac{55}{4}$	$\frac{75}{8}$	$\frac{174}{10}$	$\frac{100}{9}$
3.	$\frac{59}{11}$	$\frac{77}{9}$	$\frac{87}{5}$	$\frac{56}{8}$	$\frac{59}{11}$	$\frac{48}{7}$	$\frac{82}{9}$	$\frac{74}{8}$	$\frac{101}{12}$

To change an improper fraction to an equivalent whole or mixed number, we divide the numerator of the improper fraction by its denominator. The quotient is the whole or mixed number required.

Written Exercise

77. Change to equivalent whole or mixed numbers:

1. $\frac{188}{16}$	4. $\frac{457}{21}$	7. $\frac{559}{24}$	10. $\frac{673}{32}$	13. $\frac{833}{65}$
2. $\frac{120}{17}$	5. $\frac{500}{22}$	8. $\frac{625}{25}$	11. $\frac{784}{48}$	14. $\frac{875}{74}$
3. $\frac{882}{19}$	6. $\frac{488}{23}$	9. $\frac{589}{51}$	12. $\frac{891}{33}$	15. $\frac{791}{66}$

16. 17 half dollars equal how many dollars?

17. $\frac{6}{5}$ yards equals how many yards?

18. $3\frac{3}{4}$ hours is how much longer than $\frac{14}{4}$ hours?

Written Exercise

78. Illustrative Example. Change $\frac{24}{30}$ to an equivalent fraction in its smallest terms.

WORK

$$\frac{\overset{4}{\cancel{24}}}{\underset{5}{\cancel{30}}} = \frac{4}{5}$$

EXPLANATION. To change $\frac{24}{30}$ to its smallest terms, we must strike out of both terms their common factors, or divide both terms by their greatest common factor, 6, which gives for the equivalent fraction, $\frac{4}{5}$. *Ans.* $\frac{4}{5}$.

Change to equivalent fractions in the smallest terms:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	$\frac{12}{42}$	$\frac{26}{50}$	$\frac{27}{39}$	$\frac{36}{54}$	$\frac{44}{77}$	$\frac{120}{200}$	$\frac{141}{213}$	$\frac{860}{720}$
2.	$\frac{10}{16}$	$\frac{20}{22}$	$\frac{25}{60}$	$\frac{88}{45}$	$\frac{66}{99}$	$\frac{90}{180}$	$\frac{45}{100}$	$\frac{250}{750}$
3.	$\frac{12}{21}$	$\frac{18}{30}$	$\frac{44}{88}$	$\frac{27}{45}$	$\frac{54}{72}$	$\frac{80}{800}$	$\frac{75}{100}$	$\frac{182}{602}$

Common Denominator

79. Fractions of like denominators are said to have a **common denominator.**

80. Illustrative Example. Change $\frac{1}{12}$, $\frac{5}{6}$, and $\frac{4}{9}$ to fractions having the least common denominator.

WORK

$$\text{L. c. m.} = 2 \times 2 \times 3 \times 3 = 36$$

$$\frac{1}{12} = \frac{3}{36}$$

$$\frac{5}{6} = \frac{30}{36}$$

$$\frac{4}{9} = \frac{16}{36}$$

EXPLANATION. To change these fractions to fractions having the least common denominator, we take for the common denominator the l. c. m. of the denominators 12, 6, 9, which is 36. $\frac{1}{12} = \frac{3}{36}$; $\frac{5}{6} = \frac{30}{36}$; $\frac{4}{9} = \frac{16}{36}$.

Ans. $\frac{3}{36}$, $\frac{30}{36}$, $\frac{16}{36}$.

Change to fractions having the least common denominator:

1. $\frac{3}{4}$, $\frac{1}{9}$, $\frac{7}{8}$
2. $\frac{7}{8}$, $\frac{5}{18}$, $\frac{1}{2}$
3. $\frac{5}{8}$, $\frac{3}{4}$, $\frac{9}{10}$
4. $\frac{8}{10}$, $\frac{4}{5}$, $\frac{7}{15}$
5. $\frac{1}{2}$, $\frac{3}{11}$, $\frac{5}{12}$
6. $\frac{4}{9}$, $\frac{7}{12}$, $\frac{2}{5}$
7. $\frac{4}{15}$, $\frac{2}{3}$, $\frac{1}{2}$
8. $\frac{5}{24}$, $\frac{3}{33}$, $\frac{4}{22}$
9. $\frac{3}{8}$, $1\frac{2}{3}$, $\frac{1}{10}$

Written Exercise

81. Illustrative Example. Add $\frac{11}{12}$, $\frac{5}{6}$, $\frac{3}{8}$.

WORK

L. c. m. $= 2 \times 2 \times 3 \times 2 = 24$

$\frac{11}{12} = \frac{22}{24}$

$\frac{5}{6} = \frac{20}{24}$

$\frac{3}{8} = \frac{9}{24}$

$\frac{51}{24} = 2\frac{3}{24} = 2\frac{1}{8}$.

EXPLANATION. To add these fractions we change them to equivalent fractions having the least common denominator, which is the l. c. m. of the denominators 12, 6, and 8, or 24.

$\frac{11}{12} = \frac{22}{24}$; $\frac{5}{6} = \frac{20}{24}$; $\frac{3}{8} = \frac{9}{24}$.

$\frac{22}{24} + \frac{20}{24} + \frac{9}{24} = \frac{51}{24} = 2\frac{3}{24}$. *Ans.* $2\frac{1}{8}$.

1. $\frac{7}{8} + \frac{3}{5} + \frac{15}{20}$?
2. $\frac{5}{6} + \frac{8}{9} + \frac{19}{27}$?
3. $\frac{2}{9} + \frac{3}{16} + \frac{5}{12}$?
4. $\frac{14}{15} + \frac{4}{5} + \frac{7}{12}$?
5. $\frac{5}{6} + \frac{6}{7} + \frac{9}{14}$?
6. $\frac{2}{9} + \frac{16}{21} + \frac{5}{14}$?
7. $\frac{3}{8} + \frac{5}{16} + \frac{7}{24} + \frac{3}{48}$?
8. $\frac{1}{36} + \frac{2}{3} + \frac{1}{2} + \frac{23}{24}$?
9. $\frac{17}{48} + \frac{7}{8} + \frac{3}{4} + \frac{5}{6}$?

82. Illustrative Example. Add $7\frac{5}{6}$, $109\frac{2}{7}$, and $301\frac{8}{21}$.

WORK

42 L. c. m.

$7\frac{5}{6}$	35
$109\frac{2}{7}$	12
$301\frac{8}{21}$	16
$418\frac{1}{2}$	$\frac{63}{42} = 1\frac{21}{42} = 1\frac{1}{2}$

EXPLANATION. To add these mixed numbers we change the fractions to equivalent fractions having the least common denominator.

The l. c. m. of the denominators 6, 7, 21, is 42. $\frac{5}{6} = \frac{35}{42}$, $\frac{2}{7} = \frac{12}{42}$; $\frac{8}{21} = \frac{16}{42}$. Adding the numerators, 35, 12, and 16, gives $\frac{63}{42} = 1\frac{1}{2}$.

$7 + 109 + 301 + 1\frac{1}{2} = 418\frac{1}{2}$. *Ans.* $418\frac{1}{2}$.

10. $5\frac{4}{5} + 18\frac{7}{15} + 9\frac{9}{30}$?
11. $19\frac{1}{6} + 14\frac{3}{8} + 17\frac{2}{9}$?
12. $10\frac{2}{3} + 18\frac{8}{13} + 7\frac{1}{2}$?
13. $24\frac{1}{8} + 16\frac{7}{12} + 13\frac{5}{16}$?
14. $24\frac{1}{8} + 16\frac{1}{12} + 13\frac{3}{16}$?
15. $33\frac{1}{3} + 28\frac{2}{11} + 15\frac{7}{9}$?

16. Catherine's boat is $2\frac{1}{2}$ feet high above the keel, which is $\frac{1}{4}$ foot high. Resting on its keel the boat reaches to within $1\frac{5}{6}$ feet of the top of the boathouse. What is the inside height of the boathouse?

17. The boathouse above, is $3\frac{17}{24}$ feet longer and $2\frac{5}{6}$ feet wider, than the boat, which is $11\frac{7}{18}$ feet long and $2\frac{3}{8}$ feet wide. How long is the boathouse? How wide?

Written Exercise

83. Illustrative Example. From $\frac{11}{12}$ of a yard of lace $\frac{9}{16}$ is taken. How much is left?

WORK

48 L. c. m.

$\frac{11}{12}$	44
$\frac{9}{16}$	27
	17 / 48

EXPLANATION. To find how much is left we subtract $\frac{9}{16}$ from $\frac{11}{12}$. We first change the fractions to equivalent fractions having the least common denominator, which is 48. $\frac{11}{12} = \frac{44}{48}$; $\frac{9}{16} = \frac{27}{48}$; $\frac{44}{48} - \frac{27}{48} = \frac{17}{48}$. *Ans.* $\frac{17}{48}$ yd.

Find the remainders in the following:

1. $\frac{17}{24} - \frac{7}{20}$
2. $\frac{16}{32} - \frac{2}{16}$
3. $\frac{11}{34} - \frac{1}{10}$
4. $\frac{15}{16} - \frac{1}{12}$
5. $\frac{18}{21} - \frac{2}{7}$
6. $\frac{14}{20} - \frac{4}{15}$
7. $\frac{25}{36} - \frac{3}{8}$
8. $\frac{23}{26} - \frac{23}{39}$

84. Illustrative Example. Out of $49\frac{1}{7}$ bushels of rye take $31\frac{3}{8}$ bushels. How much remains?

WORK

56 L. c. m.

$49\frac{1}{7}$	$64(\frac{8}{56} + \frac{56}{56})$
$31\frac{3}{8}$	21
17	$43/56$

EXPLANATION. To perform the subtraction we first change the fractions to equivalent fractions having the least common denominator, which is 56. $\frac{1}{7} = \frac{8}{56}$; $\frac{3}{8} = \frac{21}{56}$. As we cannot take $\frac{21}{56}$ from $\frac{8}{56}$ we change 1 of the 49 to 56ths, which with the $\frac{8}{56} = \frac{64}{56}$. $\frac{64}{56} - \frac{21}{56} = \frac{43}{56}$; $48 - 31 = 17$. *Ans.* $17\frac{43}{56}$ bu.

Subtract:

9. $35\frac{2}{3} - 27\frac{1}{4}$
10. $49\frac{5}{6} - 38\frac{1}{3}$
11. $119\frac{5}{8} - 27\frac{1}{4}$
12. $98\frac{1}{2} - 77\frac{3}{5}$
13. $87\frac{1}{6} - 79\frac{5}{12}$
14. $31\frac{3}{4} - 10\frac{1}{7}$
15. $37\frac{3}{8} - 18\frac{3}{4}$
16. $29\frac{17}{24} - 12\frac{7}{20}$
17. $63 - 54\frac{7}{12}$
18. $73\frac{1}{10} - 67\frac{1}{100}$

Oral and Sight Exercise

85. Add or subtract as indicated:

1. $\frac{1}{4}+\frac{1}{2}$	6. $\frac{4}{5}+\frac{8}{10}$	11. $\frac{2}{3}-\frac{2}{5}$	16. $\frac{3}{5}-\frac{3}{8}$
2. $\frac{1}{2}-\frac{1}{4}$	7. $\frac{3}{4}-\frac{1}{8}$	12. $\frac{1}{2}+\frac{2}{3}$	17. $\frac{5}{6}-\frac{3}{4}$
3. $\frac{4}{8}+\frac{1}{8}$	8. $\frac{2}{3}+\frac{5}{6}$	13. $\frac{2}{3}-\frac{1}{2}$	18. $\frac{1}{2}-\frac{1}{8}$
4. $\frac{1}{3}+\frac{1}{4}$	9. $\frac{2}{5}+\frac{2}{3}$	14. $\frac{3}{8}+\frac{3}{5}$	19. $\frac{1}{4}-\frac{1}{5}$
5. $\frac{1}{3}-\frac{1}{6}$	10. $\frac{3}{5}-\frac{1}{3}$	15. $\frac{1}{7}-\frac{1}{8}$	20. $\frac{5}{8}-\frac{2}{7}$

21. $\frac{1}{2}+\frac{2}{3}+\frac{2}{5}$	24. $\frac{1}{6}+\frac{1}{9}+\frac{1}{3}$	27. $\frac{5}{6}+\frac{7}{12}+\frac{1}{6}$
22. $\frac{3}{5}+\frac{2}{3}+\frac{1}{6}$	25. $\frac{1}{2}+\frac{1}{4}+\frac{7}{8}$	28. $\frac{1}{9}+\frac{1}{3}+\frac{1}{4}$
23. $\frac{1}{4}+\frac{2}{5}+\frac{1}{8}$	26. $\frac{3}{4}+\frac{1}{2}+\frac{5}{8}$	29. $\frac{3}{7}+\frac{1}{10}+\frac{2}{14}$

Find the sum and the difference in each of the following:

30. $5\frac{3}{4}$ $2\frac{1}{2}$	31. $7\frac{5}{8}$ $4\frac{1}{4}$	32. $6\frac{2}{3}$ $4\frac{1}{6}$	33. $8\frac{5}{12}$ $6\frac{5}{6}$	34. $9\frac{1}{4}$ $3\frac{1}{3}$
35. $10\frac{5}{6}$ $5\frac{2}{3}$	36. $3\frac{1}{3}$ $1\frac{3}{4}$	37. $7\frac{1}{2}$ $2\frac{11}{12}$	38. $8\frac{3}{10}$ $5\frac{4}{5}$	39. $2\frac{1}{16}$ $1\frac{1}{8}$

40. Find the sum and the difference of $1\frac{1}{15}$ and $\frac{4}{15}$.

41. A boy who had $\$\frac{4}{5}$ gave away $\$\frac{3}{4}$. How much had he left?

42. John cut wood $\frac{1}{3}$ of one day and $\frac{1}{3}$ of the next. To what part of a day were both equal?

43. Mabel's task was to hemstitch $\frac{1}{2}$ a yard. After she had done $13\frac{1}{2}$ inches how much farther had she to hemstitch?

Oral Exercise

86. Find the gain on articles selling as follows:

Cost Price	Selling Price
1. $.08\frac{1}{3}$	$.12\frac{1}{2}$
2. $.14\frac{1}{2}$	$.18\frac{3}{4}$
3. $.16\frac{2}{3}$	$.20
4. $.13\frac{1}{3}$	$.16\frac{2}{3}$
5. $.10\frac{1}{5}$	$.12\frac{1}{2}$

Find the cost of articles selling as follows:

Selling Price	Gain
6. $.12\frac{1}{2}$	$.04\frac{1}{6}$
7. $.18	$.06\frac{1}{4}$
8. $.02\frac{1}{2}$	$.00\frac{3}{4}$
9. $.20	$.08\frac{1}{3}$
10. $.50	$.12\frac{1}{2}$

What was the selling price of articles costing as follows?

Cost Price	Gain	Cost Price	Gain
11. $.08$\frac{1}{3}$	$.04$\frac{2}{3}$	13. $ .50	$.08$\frac{1}{3}$
12. $.37$\frac{1}{2}$	$.04$\frac{1}{6}$	14. $1.00	$.16$\frac{2}{3}$

Written Exercise

87. Find the sum or remainders as indicated:

1. $\frac{7}{8}+\frac{15}{16}$
2. $19\frac{11}{12}+21\frac{1}{3}$
3. $57\frac{1}{2}-16\frac{2}{3}$
4. $33\frac{1}{3}-16\frac{2}{3}$
5. $25\frac{7}{9}-17\frac{5}{6}$
6. $48\frac{2}{15}-12\frac{1}{5}$
7. $23\frac{1}{12}-19\frac{5}{16}$
8. $25\frac{7}{9}-17\frac{5}{6}$
9. $109-41\frac{5}{16}$
10. $87-29\frac{13}{20}$
11. $62-56\frac{3}{13}$
12. $100-41\frac{5}{11}$.
13. $51\frac{1}{9}-26\frac{1}{4}$
14. $19\frac{11}{18}-7\frac{5}{24}$
15. $91\frac{17}{30}-81\frac{19}{20}$
16. $72\frac{3}{40}-37\frac{3}{30}$
17. $108\frac{17}{20}+96\frac{43}{100}-21\frac{1}{2}$
18. $97\frac{23}{30}+18\frac{1}{15}+42\frac{9}{25}$
19. $56\frac{16}{25}+67\frac{11}{20}+32\frac{67}{100}$
20. $29\frac{11}{13}+11\frac{1}{26}+\frac{1}{2}+\frac{1}{4}$
21. $\frac{8}{17}+\frac{5}{34}+\frac{3}{4}-1\frac{1}{8}$
22. $\frac{18}{19}+\frac{2}{3}+\frac{1}{2}-1\frac{1}{6}$
23. $3\frac{4}{7}+9\frac{1}{14}+6\frac{3}{8}-18$
24. $24\frac{3}{10}+13\frac{2}{15}-12\frac{4}{5}$

Written Problems

88. **1.** The thermometer at noon stood $87\frac{1}{2}$ degrees above zero; in the morning it stood 63 degrees above zero. How much higher was the thermometer at noon?

2. On the 7th of January the thermometer stood $16\frac{1}{2}$ degrees below zero in the morning, and $28\frac{1}{4}$ degrees above zero at noon. How much higher was the thermometer at noon?

3. Jane has $11\frac{1}{2}$ yards of cambric. How much must she buy to complete a dress that requires $12\frac{1}{4}$ yards?

4. If $54\frac{1}{8}$ yards of cloth shrank $1\frac{1}{4}$ yards in bleaching, what was the length of the cloth after bleaching?

5. If you lose $\$\frac{1}{8}$ on a bushel by selling rye at $\$1\frac{3}{5}$ a bushel, how much did your rye cost you a bushel?

6. Mr. Goss bought flour at $\$5\frac{9}{10}$ a barrel and gained in selling it $\$\frac{7}{20}$ a barrel. For how much a barrel did he sell it?

7. Henry has $\$1\frac{1}{2}$. How much more must he get to buy a cap worth $\$1\frac{5}{8}$ and a book worth $\$1$?

8. Find the weight of 4 tubs of butter weighing $20\frac{3}{4}$ lb., $32\frac{1}{2}$ lb., $36\frac{1}{8}$ lb., and $28\frac{7}{8}$ lb.

9. James had 50 rods to row. If he rowed $16\frac{1}{2}$ rods in one hour and $17\frac{1}{3}$ rods in another, how many more rods did he have to row?

10. A man having $347\frac{5}{16}$ acres of land, gave his son $101\frac{7}{10}$ acres and his daughter $100\frac{4}{5}$ acres. How many acres were left?

11. Mr. Grey willed $\frac{1}{10}$ of his property to his sister, $\frac{1}{3}$ to an orphan asylum, $\frac{1}{12}$ to the public library, and the remainder to a college. What part of his money did he will to the college?

12. $16\frac{1}{2}$ feet equal a rod. A meter is about $3\frac{3}{8}$ feet. Find the difference in the length of 1 rod and 1 meter.

Oral and Written Exercise

89. Illustrative Examples. Find the cost (1) of 6 spoons at $\$\frac{3}{5}$ each; (2) of 6 spoons at $\$\frac{1}{12}$ each.

WORK

(1) $\frac{3 \times 6}{5} = \frac{18}{5} = 3\frac{3}{5}$

(2) $\frac{1 \times \cancel{6}}{\cancel{12}_{2}} = \frac{1}{2}$

SOLUTION. (1) Since 1 spoon costs $\$\frac{1}{5}$, 6 spoons will cost 6 times $\$\frac{1}{5}$, $= \$\frac{1 \times 6}{5} = \$3\frac{3}{5}$. *Ans.* $\$3\frac{3}{5}$.

(2) Since 1 spoon costs $\$\frac{1}{12}$, 6 spoons will cost 6 times $\$\frac{1}{12}$, $= \$\frac{6}{12} = \$\frac{1}{2}$. *Ans.* $\$\frac{1}{2}$.

EXPLANATION. In example (1) we take 6 times the number of parts, the size remaining the same. In example (2) after expressing 6 times the number of parts, the size remaining the same, we cancel the common factor 6, and have for the answer $\frac{1}{2}$. In both examples, the work is expressed by writing the whole number in the numerator of the fraction.

To multiply a fraction by a whole number, we multiply the numerator or divide the denominator by the whole number.

Multiply, canceling when possible:

1. $\frac{4}{7}$ by 6	5. $\frac{5}{11}$ by 10	9. $\frac{10}{11}$ by 11	13. $\frac{5}{14}$ by 7
2. $\frac{5}{9}$ by 9	6. $\frac{4}{5}$ by 10	10. $\frac{11}{12}$ by 3	14. $\frac{4}{15}$ by 6
3. $\frac{2}{5}$ by 9	7. $\frac{7}{12}$ by 5	11. $\frac{5}{8}$ by 4	15. $\frac{9}{20}$ by 8
4. $\frac{3}{4}$ by 4	8. $\frac{7}{12}$ by 6	12. $\frac{9}{20}$ by 10	16. $\frac{11}{15}$ by 12

17. What is the cost of 8 yards of cloth at $\$\frac{1}{4}$ a yard?

18. At $\$\frac{5}{8}$ each, what is the cost of repairing a half dozen chairs?

19. If it takes $\frac{5}{12}$ of a year for a certain sum of money to earn $1, how long will it take it to earn $5? $9?

20. At $\$\frac{3}{10}$ an hour, how many dollars will it take to pay for 11 hours' work? for 20 hours' work?

Written Exercise

90. Illustrative Example. Multiply (1) $27\frac{3}{4}$ by 7; (2) $27\frac{3}{4}$ cents by 24.

WORK

(1) $27\frac{3}{4}$ (2) $27\frac{3}{4}$

$\times 7$ $\times 24$

$194\frac{1}{4}$ 18

108

540

666

EXPLANATION. (1) 7 times $\frac{3}{4} = \frac{21}{4} = 5\frac{1}{4}$; we write $\frac{1}{4}$ and reserve the 5. 7 times 27 = 189, which with the 5 reserved gives $194\frac{1}{4}$. *Ans.* $194\frac{1}{4}$.

(2) 24 times $\frac{3}{4}¢ = \frac{72}{4}¢ = 18¢$; 24 times 27¢ = 648¢. 18¢ + 648¢ = \$6.66. *Ans.* \$6.66.

Multiply:

1. $9\frac{1}{16}$ by 8
2. $14\frac{3}{4}$ by 12
3. $19\frac{9}{11}$ by 11
4. $21\frac{3}{7}$ by 14
5. $68\frac{2}{39}$ by 13
6. $83\frac{1}{8}$ by 16
7. $84\frac{7}{15}$ by 5
8. $57\frac{7}{30}$ by 10
9. $86\frac{2}{5}$ by 15
10. $49\frac{3}{5}$ by 25
11. $35\frac{1}{15}$ by 5
12. $43\frac{3}{4}$ by 30
13. $83\frac{1}{2}$ by 17
14. $63\frac{3}{8}$ by 27
15. $365\frac{1}{6}$ by 48
16. $458\frac{4}{5}$ by 30
17. $432\frac{5}{8}$ by 560
18. $609\frac{5}{12}$ by 636

Find the cost:

19. Of 15 dozen eggs at $16\frac{2}{3}$ cents per dozen.
20. Of 27 pounds of Formosa tea at $33\frac{1}{3}$ cents a pound.
21. Of 40 pounds of steak at $18\frac{3}{4}$ cents a pound.
22. Of 59 yards of matting at $37\frac{1}{2}$ cents a yard.
23. Of 20 boxes of raisins, each containing $57\frac{2}{5}$ pounds, at $18\frac{3}{4}$ cents a pound.
24. If a man can earn \$$53\frac{7}{8}$ a week, how much can he earn in 50 weeks?
25. If land is worth \$$2.87\frac{1}{2}$ a square foot, what is the worth of a lot that contains 1800 square feet?

Written and Oral Exercise

91. Illustrative Example. Find the cost (1) of $\frac{2}{5}$ barrel of peas at \$3 a barrel; (2) of $\frac{4}{9}$ barrel of walnuts at \$12 a barrel.

WORK

(1) $\frac{3 \times 2}{5} = \frac{6}{5} = 1\frac{1}{5}$

(2) $\frac{\overset{4}{\cancel{12}} \times 4}{\underset{3}{\cancel{9}}} = \frac{16}{3} = 5\frac{1}{3}$

SOLUTION: (1) Since 1 barrel costs \$3, $\frac{2}{5}$ barrel will cost $\frac{2}{5}$ of \$3. $\frac{1}{5}$ of \$3 is \$$\frac{3}{5}$; $\frac{2}{5}$ of \$3 is 2 times \$$\frac{3}{5}$, or \$$\frac{6}{5}$ = \$$1\frac{1}{5}$. *Ans.* \$$1\frac{1}{5}$.

(2) Since 1 barrel costs \$12, $\frac{1}{9}$ barrel will cost $\frac{1}{9}$ of \$12, which is \$$\frac{12}{9}$, and $\frac{4}{9}$ of a barrel cost 4 times \$$\frac{12}{9}$, or $\frac{\$12 \times 4}{9}$. Canceling, we have $\frac{\$4 \times 4}{3} = \frac{\$16}{3} = \$5\frac{1}{3}$. *Ans.* \$$5\frac{1}{3}$.

Finding the fractional part of a number is called **multiplying by a fraction.**

To multiply a whole number by a fraction, we multiply the whole number by the numerator of the fraction and divide by the denominator, canceling when possible.

Multiply:

1.	4 by $\frac{3}{5}$	**6.**	13 by $\frac{3}{4}$	**11.**	60 by $\frac{11}{15}$	**16.**	100 by $\frac{5}{8}$
2.	3 by $\frac{3}{5}$	**7.**	21 by $\frac{3}{7}$	**12.**	52 by $\frac{5}{13}$	**17.**	100 by $\frac{2}{3}$
3.	5 by $\frac{5}{6}$	**8.**	26 by $\frac{12}{13}$	**13.**	51 by $\frac{12}{17}$	**18.**	$\frac{3}{7}$ of 56
4.	9 by $\frac{2}{3}$	**9.**	30 by $\frac{7}{6}$	**14.**	53 by $\frac{2}{3}$	**19.**	$\frac{3}{40}$ of 200
5.	12 by $\frac{7}{10}$	**10.**	42 by $\frac{3}{14}$	**15.**	100 by $\frac{3}{8}$	**20.**	$\frac{7}{8}$ of 100

21. If the wages of a boy are \$8 a week, what are they for $\frac{5}{6}$ of a week? for $\frac{3}{2}$ weeks? for $1\frac{2}{3}$ weeks ($\frac{5}{3}$ weeks)?

22. A house rent of \$288 a year is charged $\frac{1}{8}$ less if paid by the month. What is 1 month's rent at this rate?

23. How many cubic feet are there in $1\frac{7}{8}$ cords of wood?

Written Exercise

92. Illustrative Example. Multiply (1) 33 by $13\frac{2}{5}$; (2) by $66\frac{2}{3}$.

Work			
(1)	33	(2)	33
	$13\frac{2}{5}$		$66\frac{2}{3}$
	$13\frac{1}{5}$		22
	99		198
	33		198
	$442\frac{1}{5}$		2200

EXPLANATION. Here we multiply by the fraction and the whole number separately and add their products. (1) To multiply 33 by $\frac{2}{5}$ is to take $\frac{2}{5}$ of 33. $\frac{2}{5}$ of $33 = 13\frac{1}{5}$; 13 times $33 = 429$; $13\frac{1}{5} + 429 = 442\frac{1}{5}$. *Ans.* $442\frac{1}{5}$.

(2) $\frac{2}{3}$ of $33 = 22$; 66 times $33 = 2178$; $22 + 2178 = 2200$. *Ans.* 2200.

Multiply:

1. 78 by $16\frac{3}{4}$
2. 64 by $52\frac{2}{3}$
3. 45 by $24\frac{2}{5}$
4. 97 by $37\frac{1}{6}$
5. 792 by $14\frac{9}{10}$
6. 938 by $13\frac{9}{20}$
7. 587 by $23\frac{11}{25}$
8. 804 by $8\frac{7}{12}$
9. 531 by $67\frac{1}{2}$
10. 103 by $89\frac{1}{4}$
11. 406 by $34\frac{3}{8}$
12. 763 by $56\frac{1}{7}$
13. 825 by $47\frac{4}{5}$
14. 628 by $98\frac{5}{6}$
15. 892 by $78\frac{5}{8}$
16. 699 by $526\frac{2}{5}$
17. 790 by $69\frac{7}{10}$
18. 627 by $59\frac{5}{9}$.

Find the cost:

19. Of $6\frac{3}{4}$ lb. of butter at 24 cents a pound.
20. Of $2\frac{7}{8}$ lb. of cheese at 11 cents a pound.
21. Of $5\frac{5}{6}$ lb. of flour at \$3.35 a barrel.
22. Of $76\frac{2}{5}$ tons of coal at \$7.50 a ton.
23. Of $18\frac{3}{4}$ feet of boards at 23 cents a foot.
24. A man rented a store at the rate of \$750 a year. What was the amount of the rent for $7\frac{5}{6}$ years?
25. What is the cost of a railroad ticket at 2¢ a mile for $45\frac{7}{8}$ miles?

Written and Oral Exercise

93. Illustrative Examples. Multiply $\frac{3}{4}$ by $\frac{3}{5}$.

WORK

$$\frac{3 \times 3}{4 \times 5} = \frac{9}{20}$$

EXPLANATION. To multiply $\frac{3}{4}$ by $\frac{3}{5}$ is to take $\frac{3}{5}$ of $\frac{3}{4}$. To get $\frac{1}{5}$ of $\frac{1}{4}$ we must divide $\frac{1}{4}$ into 5 equal parts. This is expressed by multiplying the denominator 4 by 5, thus, $\frac{1}{4 \times 5}$ which gives $\frac{1}{20}$. Since $\frac{1}{5}$ of $\frac{1}{4}$ is $\frac{1}{20}$, $\frac{1}{5}$ of $\frac{3}{4}$ is $\frac{3}{20}$, and $\frac{3}{5}$ of $\frac{3}{4}$ is 3 times $\frac{3}{20}$, or $\frac{3 \times 3}{4 \times 5} = \frac{9}{20}$. *Ans.* $\frac{9}{20}$.

To multiply a fraction by a fraction, we multiply the numerators together for a new numerator and the denominators together for a new denominator.

Multiply, canceling when possible:

1. $\frac{4}{5}$ by $\frac{2}{3}$	5. $\frac{2}{5}$ by $\frac{3}{4}$	9. $\frac{3}{8}$ by $\frac{5}{7}$	13. $\frac{3}{5}$ of $\frac{5}{12}$
2. $\frac{3}{8}$ by $\frac{3}{5}$	6. $\frac{3}{5}$ by $\frac{3}{5}$	10. $\frac{2}{3}$ by $\frac{7}{10}$	14. $\frac{2}{9}$ of $\frac{7}{16}$
3. $\frac{11}{15}$ by $\frac{3}{7}$	7. $\frac{2}{3}$ by $\frac{7}{12}$	11. $\frac{7}{6}$ by $\frac{4}{11}$	15. $\frac{3}{9}$ of $\frac{12}{18}$
4. $\frac{3}{4}$ by $\frac{2}{3}$	8. $\frac{4}{9}$ by $\frac{5}{8}$	12. $\frac{8}{11}$ by $\frac{3}{7}$	16. $\frac{3}{5}$ of $3\frac{3}{4}$

WORK OF EXAMPLE 16

$$\frac{\overset{3}{\cancel{15}} \times 3}{4 \times \underset{1}{\cancel{5}}} = \frac{9}{4} = 2\tfrac{1}{4}.$$

EXPLANATION. In example 16 we change $3\frac{3}{4}$ to a fraction and, canceling, have for the product $2\frac{1}{4}$.

17. $1\frac{5}{6}$ by $\frac{3}{4}$	19. $5\frac{5}{8}$ by $\frac{4}{9}$	21. $1\frac{3}{8}$ by $\frac{5}{6}$	23. $\frac{7}{20}$ of $2\frac{2}{7}$
18. $2\frac{5}{6}$ by $\frac{1}{9}$	20. $3\frac{1}{3}$ by $\frac{3}{5}$	22. $2\frac{1}{7}$ by $\frac{5}{3}$	24. $\frac{4}{21}$ of $8\frac{2}{5}$

94. Illustrative Example. Find $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{14}{15}$ of an estate.

WORK

$$\frac{\overset{7}{\cancel{14}}}{15 \times \underset{1}{\cancel{2}} \times 2} = \frac{7}{30}$$

SOLUTION. $\frac{1}{2}$ of $\frac{14}{15} = \frac{7}{15}$; $\frac{1}{2}$ of $\frac{7}{15} = \frac{7}{30}$. *Ans.* $\frac{7}{30}$ of estate.

A fraction of a fraction is called a **compound fraction.**

The process of changing a compound to a simple fraction is the same as the process of multiplying a fraction by a fraction.

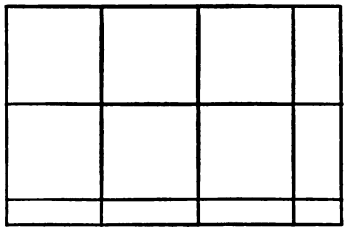
Written and Oral Exercise

95. Find:

1. $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{6}$
2. $\frac{3}{5}$ of $\frac{7}{12}$ of $\frac{6}{8}$
3. $\frac{6}{7}$ of $\frac{9}{10}$ of $\frac{5}{8}$
4. $\frac{3}{5}$ of $\frac{5}{7}$ of $\frac{14}{21}$
5. $\frac{1}{3}$ of $\frac{5}{8}$ of $\frac{4}{9}$
6. $\frac{5}{6}$ of $\frac{8}{15}$ of $\frac{3}{20}$
7. $\frac{9}{13}$ of $\frac{4}{15}$ of $\frac{26}{27}$
8. $\frac{3}{4}$ of $\frac{3}{5}$ of \$10
9. $1\frac{3}{14}$ of $\frac{7}{9}$ of $\frac{30}{21}$ of $5\frac{3}{8}$
10. $\frac{7}{9}$ of $\frac{6}{14}$ of $\frac{8}{15}$ of $6\frac{3}{7}$
11. $\frac{10}{11}$ of $\frac{3}{16}$ of $\frac{6}{9}$ of 22
12. $1\frac{1}{12}$ of $3\frac{3}{7}$ of $\frac{35}{22}$ of 60

13. A woman inherited $\frac{3}{100}$ of a mine. $\frac{2}{3}$ of this she divided equally among her 4 children. What part did each child receive?

14. A dress pattern cost \$$12\frac{1}{2}$, the making $\frac{3}{5}$ as much, and the trimming $\frac{2}{3}$ as much as the making. Find the cost of the trimmings.



96. Illustrative Example. The picture represents a table top drawn to the scale of $\frac{1}{2}$ inch to the foot. It is how many feet long and how many feet wide? A surface $3\frac{1}{2}$ feet long and $2\frac{1}{4}$ feet wide contains how many square feet?

WORK

$3\frac{1}{2}=\frac{7}{2}$; $2\frac{1}{4}=\frac{9}{4}$

$\frac{7}{2}\times\frac{9}{4}=\frac{63}{8}=7\frac{7}{8}$

EXPLANATION. To find the number of square feet we multiply $3\frac{1}{2}$ by $2\frac{1}{4}$.

To multiply a mixed number by a mixed number, we change the mixed numbers to equivalent fractions and multiply as we multiply fractions.

When the terms of the fractions are large, it may be easier to multiply the whole number, and the fractions separately.

15. $8\frac{1}{4}\times5\frac{3}{5}=?$ 16. $7\frac{5}{6}\times8\frac{1}{6}=?$ 17. $4\frac{7}{11}\times14\frac{2}{3}=?$ 18. $7\frac{7}{8}\times6\frac{2}{7}=?$

Oral Exercise

97. Find the sum of:

1. \$ $\frac{1}{4}$ and \$ $\frac{1}{2}$
2. \$ $\frac{1}{5}$ and \$ $\frac{1}{4}$
3. $\frac{1}{4}$ ft. and $\frac{1}{8}$ ft.
4. $\frac{1}{6}$ oz. and $\frac{1}{4}$ oz.
5. $\frac{3}{7}$ wk. and $\frac{4}{21}$ wk.
6. $\frac{3}{8}$ gal. and $\frac{1}{2}$ gal.
7. $\frac{1}{5}$ mile and $\frac{1}{8}$ mile
8. $1\frac{7}{4}$ lb. and $1\frac{1}{8}$ lb.
9. $\frac{1}{2}$ doz. and $\frac{1}{4}$ doz.
10. Change to their smallest terms $\frac{5}{20}$, $\frac{2}{14}$, $\frac{8}{18}$, $\frac{4}{6}$.
11. Change to their smallest terms $\frac{22}{24}$, $\frac{18}{24}$, $\frac{12}{28}$, $\frac{24}{30}$.

98. Reduce (change) to improper fractions:

	a	*b*	*c*	*d*	*e*	*f*
12.	\$ $5\frac{1}{4}$	\$ $9\frac{1}{5}$	$8\frac{7}{8}$ gal.	$12\frac{1}{2}$ pt.	$5\frac{5}{12}$ in.	$7\frac{5}{8}$ mi.
13.	\$ $3\frac{2}{6}$	\$ $2\frac{3}{8}$	$4\frac{2}{5}$ pk.	$10\frac{2}{7}$ oz.	$11\frac{4}{5}$ yd.	$7\frac{3}{5}$ rd.

Find the value of:

	g	*h*	*i*	*j*
14.	$\frac{1}{3} - \frac{1}{4}$	$\frac{7}{12}$ ft. $- \frac{1}{2}$ ft.	$7 \times \frac{2}{5}$ yd.	$\frac{2}{5} \times$ \$ $\frac{7}{10}$
15.	$\frac{1}{5} - \frac{1}{6}$	$\frac{5}{6}$ da. $- \frac{1}{3}$ da.	$4 \times \frac{3}{8}$ day.	$\frac{4}{5} \times 6\frac{1}{4}$ ¢.
16.	$5\frac{1}{2} - \frac{3}{4}$	$4\frac{3}{8}$ bu. $- 1\frac{5}{6}$ bu.	$\frac{3}{4}$ of $\frac{1}{2}$ yr.	$\frac{1}{3}$ of $7\frac{1}{2}$

17. A street is $\frac{7}{8}$ of a mile long; $\frac{3}{8}$ of it is paved. What part of a mile is paved?

18. If a glass of soda costs the druggist $2\frac{5}{8}$ ¢, how much does he gain on a glass by selling it at 5 cents?

19. Find the cost of 9 boxes of soap at \$ $2\frac{3}{4}$ a box.

20. Find the cost of $1\frac{7}{9}$ yards of carpet at \$ 1.08 a yard.

21. Find the cost of $11\frac{1}{4}$ lb. of chicken at 20 cents per pound.

22. Find the cost of $\frac{1}{2}$ a day's work at \$ $2\frac{3}{5}$ a day.

Written Exercise

99. Add:

1. $29\frac{1}{3}$	2. $27\frac{1}{5}$	3. $36\frac{1}{4}$	4. $75\frac{1}{6}$	5. $65\frac{2}{3}$
$37\frac{1}{2}$	$38\frac{1}{3}$	$97\frac{3}{8}$	$19\frac{1}{2}$	$58\frac{3}{6}$
$46\frac{1}{6}$	$87\frac{1}{15}$	$48\frac{1}{2}$	$47\frac{3}{4}$	$49\frac{5}{8}$

Subtract:

6. $53\frac{1}{2}$	7. $68\frac{1}{8}$	8. $62\frac{4}{10}$	9. $86\frac{5}{6}$	10. $367\frac{1}{3}$
$19\frac{1}{4}$	$22\frac{1}{5}$	$42\frac{3}{5}$	$35\frac{3}{4}$	$198\frac{2}{3}$

11. I burned $12\frac{3}{4}$ tons of coal in my furnace last year, and $11\frac{5}{8}$ tons the winter before. How much did I burn in both years?

12. Add forty-five and seven eighths, seventy-four and five sixths, and fifty-nine and five twelfths.

Find the cost:

13. Of 9 yards of cloth at $\$10\frac{3}{4}$ a yard.

14. Of $7\frac{5}{6}$ yards of cloth at $16¢$ a yard.

15. Of 20 pounds of sugar at $5\frac{1}{4}¢$ a pound.

16. Of $6\frac{1}{2}$ pounds of sugar at $7¢$ a pound.

17. Of 21 dozen eggs at $16\frac{2}{3}¢$ a dozen.

18. Of $23\frac{7}{12}$ dozen eggs at 27 cents a dozen.

19. Of $15\frac{1}{2}$ tons of hay at $\$8\frac{3}{4}$ a ton.

20. Of $\frac{1}{3}$ of $\frac{7}{8}$ of a ton of fertilizer at \$15 a ton.

21. Of 28 yards of carpet at $\$2\frac{7}{8}$ a yard.

22. Of $3\frac{4}{9}$ yards of carpet at $\$2\frac{1}{4}$ a yard.

23. Of the labor of 75 men $8\frac{1}{3}$ hours at $\$\frac{2}{5}$ an hour.

24. Of $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of a \$6000 house.

Oral Problems

100 1. How much will $\frac{1}{2}$ dozen eggs weigh at an average weight of $1\frac{3}{8}$ pounds to the dozen?

2. What will be the cost of $\frac{3}{4}$ of an acre of land at $28 an acre?

3. How long will it take to go $3\frac{1}{3}$ miles, going at the rate of a mile in $\frac{1}{30}$ of an hour?

4. A cubic foot of water weighs $\frac{5}{8}$ of a hundred pounds. How much will $1\frac{3}{5}$ cubic feet weigh?

5. Enos is $2\frac{1}{2}$ years old. He has a sister $2\frac{1}{2}$ times as old as he is. How old is his sister?

6. A tree is now 25 feet high; it has grown $\frac{1}{10}$ of this height in a year. What was its height a year ago?

7. How many square yards are there in a sheet that is $2\frac{1}{2}$ yards by $1\frac{1}{2}$ yards?

8. $5\frac{1}{2}$ yards equal 1 rod. $5\frac{1}{2} \times 5\frac{1}{2}$ gives the square yards in a square rod. How many square yards are there in 1 square rod?

A short way of multiplying $5\frac{1}{2}$ by $5\frac{1}{2}$ is to multiply 5 by 6 and add $\frac{1}{2}$ of $\frac{1}{2}$ to the product. Show why this is so, and apply the principle to examples.

9. Find the number of square feet in three pieces of floor, the first, $1\frac{1}{2}$ ft. by $1\frac{1}{2}$ ft., the second, $2\frac{1}{2}$ ft. by $2\frac{1}{2}$ ft., the third, $3\frac{1}{2}$ ft. by $3\frac{1}{2}$ ft.

10. A floor is $10\frac{1}{2}$ ft. by $10\frac{1}{2}$ ft. Find its surface in square feet.

11. Find the cost of $11\frac{1}{2}$ yards of dimity at $11\frac{1}{2}$ cents a yard.

12. Find the cost of $3\frac{1}{8}$ dozen collars at $\$1\frac{1}{8}$ dozen.

Oral or Written Problems

101. 1. A fast express runs from Boston to New York in $5\frac{1}{4}$ hours. A slower train makes the run in $6\frac{1}{2}$ hours. What is the difference in time?

2. At $\$5\frac{1}{4}$ each what is the cost of 3 dozen shirt waists?

3. If from a 5-gallon can of molasses $\frac{1}{3}$ is used at one time and $\frac{1}{4}$ of the remainder at another time, how many gallons remain in the can?

4. A street is $3\frac{1}{2}$ rods wide. $16\frac{1}{2}$ feet equal 1 rod. What is the width of the street in feet?

5. Make a drawing to represent a floor 17 ft. long and $15\frac{1}{2}$ ft. wide. Find how many square feet it has.

6. At $2\frac{1}{6}$ cents a square foot how much must I pay for a piece of land 216 ft. by 180 ft.?

7. An oil tank is 9 ft. by 6 ft. by 4 ft. How many gallons will it hold, reckoning $7\frac{1}{2}$ gallons to a cubic foot?

8. A coal dealer bought 4 car loads of coal of the following weights: $36\frac{2}{3}$ tons, $24\frac{7}{8}$ tons, $23\frac{5}{8}$ tons, and $31\frac{3}{4}$ tons. Find the total weight.

9. Find the cost of a chest of tea, containing 57 pounds, at $\$\frac{5}{8}$ a pound.

10. A box is $6\frac{1}{2}$ in. deep, $10\frac{3}{4}$ in. long, and $5\frac{1}{3}$ in. wide. Multiply these numbers together and find the number of cubic inches in the box.

11. A tunnel $5\frac{7}{36}$ miles long is being bored through a mountain. The borings extend at one end $2\frac{3}{8}$ miles, at the other $2\frac{5}{12}$ miles. How much less than a mile, 5280 feet, is what remains to be bored?

12. Of the above tunnel what fraction of a mile remains to be bored?

Oral or Written Work

102. Illustrative Example. (1) Divide $\frac{4}{5}$ of a bushel of oats equally between two horses. (2) Divide $\frac{3}{5}$ of a bushel equally between 2 horses. What part of a bushel will 1 horse get?

WORK

(1) $\frac{1 \times \cancel{4}}{\cancel{2} \times 5} = \frac{2}{5}$

(2) $\frac{1 \times 3}{2 \times 5} = \frac{3}{10}$

EXPLANATION. Each horse will get $\frac{1}{2}$ the oats. To find $\frac{1}{2}$ of a number we divide it by 2.

In example (1) we divide the numerator. Here we take $\frac{1}{2}$ the number of parts, the size remaining the same. In example (2) we multiply the denominator. Here we make the parts $\frac{1}{2}$ as large, the number of parts remaining the same.

To divide a fraction by a whole number, we divide the numerator or multiply the denominator by the whole number.

In written work we express the division by writing the whole number in the denominator, and canceling when we can.

Divide:

1. $\frac{3}{4}$ by 3	4. $\frac{6}{7}$ by 3	7. $\frac{5}{7}$ by 2	10. $\frac{8}{9}$ by 5
2. $\frac{3}{4}$ by 2	5. $\frac{7}{8}$ by 4	8. $\frac{4}{11}$ by 6	11. $\frac{36}{7}$ by 9
3. $\frac{2}{4}$ by 3	6. $\frac{8}{5}$ by 5	9. $\frac{8}{9}$ by 6	12. $6\frac{2}{3}$ by 10

WORK OF EXAMPLE 12

$6\frac{2}{3} = \frac{20}{3}$;

$\frac{\cancel{20} \times 1}{3 \times \cancel{10}} = \frac{2}{3}$.

EXPLANATION. In example 12 we change $6\frac{2}{3}$ to a fraction, and, after canceling, have for the quotient $\frac{2}{3}$.

13. $3\frac{3}{4} \div 5$	15. $2\frac{1}{8} \div 4$	17. $7\frac{1}{3} \div 11$	19. $2\frac{4}{5} \div 8$
14. $1\frac{1}{7} \div 5$	16. $3\frac{1}{5} \div 7$	18. $4\frac{1}{4} \div 9$	20. $10\frac{4}{5} \div 18$

21. A meter is about $39\frac{3}{8}$ inches in length. The diameter of a nickel is $\frac{1}{50}$ of a meter. What part of an inch is the diameter of a nickel? Measure, and see if your answer agrees with the measurement.

Oral and Written Exercises

103. 1. \$8$\frac{1}{2}$ is paid for 6 yards of carpeting. What is the price per yard?

2. For 5 days' work a woman is paid \$12$\frac{1}{2}$. What is the rate per day?

3. A man harvested a lot of apples in 4$\frac{2}{5}$ days. How long should it have taken 4 men to do it?

4. A product is 6$\frac{3}{5}$ with a multiplier of 11. What was the multiplicand?

5. When 11$\frac{3}{5}$ inches of ice form in a week, what is the average per day?

6. The greatest rainfall in the United States, including melted snow, is at Cape Hatteras, where the yearly average is 66$\frac{2}{3}$ inches. What is the average monthly rainfall?

7. In Nevada, the average yearly rainfall is 8$\frac{1}{2}$ inches. What is the average per month?

104. Illustrative Example. Divide 157$\frac{3}{5}$ by 4.

WORK

39$\frac{3}{5}$ quotient

4)157$\frac{3}{5}$ dividend

EXPLANATION. When the mixed number is large, we divide the whole number as far as possible without changing it to the fractional form, thus, 157$\frac{3}{5}$ divided by 4 equals 39 with 1$\frac{3}{5}$ undivided. 1$\frac{3}{5}$ = $\frac{8}{5}$, which divided by 4 gives $\frac{2}{5}$. The entire quotient is 39$\frac{2}{5}$.

Ans. 39$\frac{2}{5}$.

Divide:

8. 14$\frac{1}{4}$ by 3
9. 85$\frac{2}{3}$ by 2
10. 48$\frac{1}{5}$ by 5
11. 92$\frac{3}{4}$ by 7
12. 18$\frac{3}{8}$ by 4
13. 102$\frac{2}{5}$ by 8
14. 320$\frac{2}{5}$ by 9
15. 333$\frac{1}{3}$ by 10
16. 975$\frac{1}{5}$ by 12
17. 478$\frac{1}{2}$ by 11
18. 313$\frac{1}{3}$ by 6
19. 810$\frac{2}{7}$ by 3

Written Exercise

105. Illustrative Example. Divide $742\frac{1}{2}$ by 33.

WORK

(1)
$$\begin{array}{r} 22\frac{1}{2} \\ 33\overline{)742\frac{1}{2}} \\ 66\phantom{\frac{1}{2}} \\ \hline 82\phantom{\frac{1}{2}} \\ 66\phantom{\frac{1}{2}} \\ \hline 16\frac{1}{2} = \frac{33}{2} \end{array}$$

$$\frac{\overset{1}{\cancel{33}}}{2 \times \cancel{33}} = \frac{1}{2}$$

WORK

(2)
$$\begin{array}{r} 33 \\ 2 \\ \hline 66 \end{array} \quad \begin{array}{r} 742\frac{1}{2} \\ 2 \\ \hline 1485(22\frac{1}{2} \\ 132\phantom{(22\frac{1}{2}} \\ \hline 165\phantom{(22\frac{1}{2}} \\ 132\phantom{(22\frac{1}{2}} \\ \hline \frac{33}{66} = \frac{1}{2} \end{array}$$

quotient

EXPLANATION. When it is necessary to use long division, the work can be done by either of the two ways illustrated.

(2) consists in changing both the dividend and divisor to halves, and then dividing as we divide whole numbers.

Ans. $22\frac{1}{2}$.

Divide

1. $972\frac{2}{5}$ by 13
2. $408\frac{1}{6}$ by 21
3. $233\frac{2}{3}$ by 19
4. $716\frac{4}{5}$ by 32
5. $846\frac{2}{9}$ by 44
6. $762\frac{3}{10}$ by 55
7. $333\frac{2}{3}$ by 66
8. $585\frac{3}{5}$ by 72
9. $590\frac{2}{5}$ by 24
10. $813\frac{3}{8}$ by 27
11. $609\frac{3}{7}$ by 54
12. $987\frac{1}{2}$ by 47

13. In 8 months my furnace burned $14\frac{1}{2}$ tons of coal. What was the average per month?

14. 24 railroad fares from Montreal to Boston were $\$165\frac{3}{5}$. How much was a single fare?

15. A distance of $1041\frac{2}{3}$ feet on a city street is fronted by 25 lots of equal width. What is the width of one lot?

16. A hotel bill for 18 days' board was $\$49\frac{1}{2}$. What was the price per day?

17. When 17 breadths of wall paper reach $314\frac{1}{2}$ inches, how many inches wide is the paper?

Oral or Written Exercise

106. Illustrative Example. At $\$\frac{4}{5}$ a yard, how many yards of lace can be bought for \$11?

WORK

$\$11 = \$\frac{55}{5}$

$4)55$

$13\frac{3}{4}$

SOLUTION. For \$11 we can buy as many yards as $\$\frac{4}{5}$ is contained times in \$11. $11 = \frac{55}{5}$; $\frac{4}{5}$ is contained in $\frac{55}{5}$ as many times as 4 is contained in 55, which is $13\frac{3}{4}$.

Ans. $13\frac{3}{4}$ yards.

EXPLANATION. In this example we make the dividend, 11, of the same denomination as the divisor, and then divide the numerator of the dividend by that of the divisor.

1. How many boxes, each holding $\frac{3}{5}$ bushel, can be filled from 6 bushels of apples?

2. How many towels, each measuring $\frac{7}{8}$ of a yard, can be made from 8 yards of crash?

3. If $\frac{2}{3}$ of an inch represents 1 mile on a map, how many miles do 10 inches represent?

4. How many caps at $\$1\frac{3}{5}$ each can be bought for \$16?

WORK OF EXAMPLE 4

$16 = \frac{80}{5}$; $1\frac{3}{5} = \frac{8}{5}$;

$80 \div 8 = 10$.

EXPLANATION. In doing Example 4, we change 16 and $1\frac{3}{5}$ both to fifths.

Divide:

5. 28 by $\frac{7}{10}$ 7. 84 by $1\frac{2}{5}$ 9. 63 by $2\frac{5}{8}$ 11. 100 by $4\frac{1}{6}$

6. 9 by $\frac{5}{6}$ 8. 36 by $1\frac{1}{5}$ 10. 52 by $1\frac{2}{11}$ 12. 150 by $3\frac{3}{4}$

13. 1 rod is $16\frac{1}{2}$ feet. 1 mile is 5280 feet. How many rods are there in 1 mile?

14. How long would it take 10 men to do as much work as 1 man can do in $6\frac{2}{3}$ days? How long would it take 8 men to do as much?

Written Exercise

107. Illustrative Examples. (1) At $\$\frac{3}{10}$ a yard for ribbon, how many yards can be bought for $\$\frac{5}{6}$? (2) Divide $\frac{2}{3}$ by $\frac{3}{4}$.

(1)

WORK

$\frac{5}{6} = \frac{25}{30}$

$\frac{3}{10} = \frac{9}{30}$

$\frac{25}{30} \div \frac{9}{30} = 2\frac{7}{9}$

SOLUTION: (1) As many yards can be bought for $\$\frac{3}{10}$ as $\$\frac{3}{10}$ is contained times in $\$\frac{5}{6}$. Changing $\frac{3}{10}$ and $\frac{5}{6}$ to fractions having the common denominator 30, we have $\frac{25}{30}$ to be divided by $\frac{9}{30}$, which gives for a quotient $2\frac{7}{9}$. *Ans.* $2\frac{7}{9}$ yards.

(2)

WORK

$\frac{2}{3} = \frac{8}{12}$

$\frac{3}{4} = \frac{9}{12}$

$\frac{8}{12} \div \frac{9}{12} = \frac{8}{9}$

EXPLANATION. (2) Changing $\frac{2}{3}$ and $\frac{3}{4}$ to fractions having the common denominator 12, we have $\frac{8}{12} \div \frac{9}{12} = \frac{8}{9}$. *Ans.* $\frac{8}{9}$.

Or, if we express the work in full thus, $\frac{2}{3} = \frac{2 \times 4}{12}$; $\frac{3}{4} = \frac{3 \times 3}{12}$; $\frac{2 \times 4}{12} \div \frac{3 \times 3}{12} = \frac{2 \times 4}{3 \times 3} = \frac{8}{9}$, from which it appears that multiplying the dividend by the divisor inverted gives the quotient.

To divide a fraction by a fraction, we change both fractions to fractions having a common denominator, and then divide the numerator of the dividend by the numerator of the divisor.

Or, *We multiply the dividend by the divisor inverted.*

1. $\frac{5}{8}$ by $\frac{3}{4}$
2. $\frac{8}{9}$ by $\frac{2}{3}$
3. $\frac{9}{10}$ by $\frac{6}{7}$
4. $4\frac{1}{5}$ by $\frac{3}{7}$
5. $4\frac{2}{7}$ by $\frac{5}{12}$
6. $2\frac{4}{15}$ by $\frac{5}{6}$
7. $5\frac{2}{3}$ by $\frac{4}{9}$
8. $3\frac{6}{11}$ by $1\frac{5}{8}$

9. A yard is $\frac{2}{11}$ of a rod. How many yards are there in $14\frac{1}{2}$ rods?

10. A heaped bushel is $\frac{5}{4}$ of an even bushel. How many bushels of apples, heaped measure, can be put into barrels that hold just 7 bushels of shell beans, even measure?

11. $7\frac{1}{2}$ marks in German money equal $\$1.78\frac{1}{2}$. What is the value of 1 mark?

12. How many years of $365\frac{1}{4}$ days are there in $2191\frac{1}{2}$ days?

Written Exercise

108. Divide:

1. $\frac{4}{5}$ by $\frac{2}{3}$
2. $\frac{1}{4}$ by $\frac{3}{4}$
3. $\frac{2}{7}$ by $\frac{2}{3}$
4. $\frac{3}{4}$ by $\frac{2}{3}$
5. $\frac{7}{8}$ by $\frac{1}{4}$
6. $\frac{4}{5}$ by $\frac{1}{3}$
7. $\frac{5}{7}$ by $\frac{2}{3}$
8. $\frac{5}{8}$ by $\frac{5}{6}$
9. $\frac{3}{8}$ by $\frac{1}{7}$
10. $\frac{5}{6}$ by $\frac{1}{4}$
11. $\frac{3}{4}$ by $\frac{5}{6}$
12. $\frac{3}{8}$ by $\frac{3}{4}$
13. $\frac{5}{6}$ by $\frac{2}{7}$
14. $\frac{3}{4}$ by $\frac{2}{10}$
15. $\frac{1}{4}$ by $\frac{2}{7}$
16. $\frac{5}{8}$ by $\frac{1}{6}$
17. $6\frac{1}{3}$ by $\frac{2}{5}$
18. $5\frac{3}{5}$ by $\frac{3}{4}$
19. $8\frac{2}{3}$ by $\frac{7}{8}$
20. $9\frac{5}{6}$ by $\frac{1}{2}$
21. $12\frac{3}{10}$ by $\frac{2}{3}$
22. $5\frac{5}{7}$ by $\frac{5}{6}$
23. $8\frac{3}{4}$ by $\frac{1}{4}$
24. $10\frac{1}{3}$ by $\frac{1}{2}$
25. $3\frac{1}{3}$ by $\frac{3}{4}$
26. $7\frac{1}{2}$ by $\frac{2}{5}$
27. $6\frac{1}{5}$ by $\frac{1}{3}$
28. $10\frac{1}{2}$ by $\frac{1}{2}$
29. $\frac{7}{4}$ by $\frac{3}{5}$
30. $\frac{40}{3}$ by $\frac{16}{5}$
31. $8\frac{5}{9}$ by $\frac{25}{22}$
32. $\frac{100}{3}$ by $\frac{33}{20}$

109. Illustrative Example. Divide $5\frac{5}{7}$ by $3\frac{1}{5}$.

WORK

$5\frac{5}{7} = \frac{40}{7} = \frac{200}{35}$

$3\frac{1}{5} = \frac{16}{5} = \frac{112}{35}$

$200 \div 112 = 1\frac{88}{112} = 1\frac{11}{14}$

EXPLANATION. To divide a mixed number by a mixed number, we change them both to improper fractions having a common denominator. $5\frac{5}{7} = \frac{40}{7}$; $3\frac{1}{5} = \frac{16}{5}$; $\frac{40}{7} \div \frac{16}{5} = \frac{200}{35} \div \frac{112}{35} = 1\frac{11}{14}$. *Ans.* $1\frac{11}{14}$.

33. $9\frac{3}{4}$ by $12\frac{2}{3}$
34. $15\frac{5}{6}$ by $6\frac{4}{5}$
35. $2\frac{5}{8}$ by $1\frac{7}{12}$
36. $8\frac{3}{4}$ by $1\frac{6}{7}$
37. $1\frac{3}{4}$ by $4\frac{1}{3}$
38. $12\frac{5}{6}$ by $1\frac{1}{10}$
39. $6\frac{2}{3}$ by $3\frac{2}{5}$
40. $8\frac{8}{5}$ by $4\frac{8}{10}$
41. $2\frac{7}{8} \div 3\frac{7}{8}$
42. $6\frac{9}{10} \div 4\frac{2}{15}$
43. $5\frac{2}{5} \div 8\frac{1}{3}$
44. $5\frac{4}{9} \div 12\frac{5}{6}$
45. $2\frac{7}{24} \div 1\frac{7}{18}$
46. $2\frac{4}{15} \div 1\frac{11}{40}$
47. $5\frac{4}{5} \div 8\frac{4}{7}$
48. $66\frac{2}{3} \div 4\frac{4}{9}$

49. How many pieces of curtain cord $\frac{3}{4}$ of a yard long can be cut from $10\frac{1}{2}$ yards?

50. If $7\frac{1}{2}$ pounds of chicken cost $1\frac{1}{2}$ dollars how much will $3\frac{1}{2}$ pounds cost?

51. 10 dollars is paid for insurance on a house. The rate is $\frac{2}{5}$ % on a dollar insured. How much is insured?

Written Exercise

110. 1. If $\frac{5}{6}$ ounce of pure gold is extracted from 1 ton of ore, how much ore is required to yield 250 ounces of pure gold?

2. A barrel contains $31\frac{1}{2}$ gallons. How many barrels will be required to hold 724 gallons?

3. A retaining wall 7 rods long ($16\frac{1}{2}$ feet to the rod) was laid at an expense of $\$483\frac{1}{4}$. What was the cost per foot?

4. How many steps $2\frac{2}{3}$ feet each are there in 45 rods?

5. A tailoring establishment pays $\$109\frac{1}{5}$ for making garments at $\$3\frac{9}{10}$ each. What number of garments are made?

6. Using $\frac{2}{5}$ pounds of cotton to the yard, how many yards of cloth can be made from 100 pounds of cotton?

7. The weight of well-seasoned beech wood being $43\frac{1}{8}$ pounds to the cubic foot, how many pounds are there in $258\frac{3}{4}$ cubic feet?

8. The Hoosac tunnel, which is $4\frac{3}{4}$ miles long, was built at an expense of about $\$14,000,000$. What was the average cost per mile?

9. What was the cost per mile for building the ship canal, $35\frac{1}{2}$ miles, from Liverpool to Manchester, the whole expense being $\$75,000,000$?

For collecting bills a man receives a certain number of cents on each dollar of the money he collects. Find the sums collected, the money he received for collecting being as follows:

10. Money received for collecting, $\$8.75$; rate $3\frac{1}{2}\cent$ on 1 dollar.

11. Money received for collecting, $\$1.75$; rate $2\frac{1}{2}\cent$ on 1 dollar.

12. Money received for collecting, $\$3.06$; rate $4\frac{1}{4}\cent$ on 1 dollar.

13. Money received for collecting, $\$3.60$; rate $7\frac{1}{2}\cent$ on 1 dollar.

14. Goods that were sold for $\$620.20$ were sold for $85\cent$ on a dollar of their cost. How much did they cost? How much would they have sold for to gain $15\cent$ on a dollar?

Written Exercise

111. Subtract:

1. $53\frac{1}{2}$	3. $62\frac{3}{10}$	5. $94\frac{1}{3}$	7. $54\frac{5}{8}$	9. $57\frac{3}{4}$
$-19\frac{1}{4}$	$-42\frac{1}{5}$	$-73\frac{1}{2}$	$-25\frac{3}{4}$	$-18\frac{3}{5}$
2. $68\frac{1}{6}$	4. $86\frac{5}{6}$	6. $59\frac{1}{2}$	8. $63\frac{1}{4}$	10. $367\frac{1}{9}$
$-22\frac{1}{6}$	$-35\frac{3}{4}$	$-54\frac{3}{5}$	$-17\frac{1}{8}$	$-198\frac{2}{3}$

11. A quart, dry measure, contains $67\frac{1}{5}$ cubic inches; a quart, liquid measure, contains $57\frac{3}{4}$ cubic inches. How much larger is the dry quart than the liquid quart?

12. To plow a field took $8\frac{5}{6}$ hours; to plant it took $15\frac{2}{3}$ hours. How much longer did it take to plant the field than to plow it?

13. James is $5\frac{3}{8}$ feet tall, and John is $3\frac{3}{4}$ feet tall. How much taller is James than John?

14. From $18\frac{3}{8}$ yards of cloth were cut $7\frac{1}{2}$ yards and $3\frac{3}{4}$ yards. How much was left?

15. From a basket containing $19\frac{3}{4}$ quarts of berries, $5\frac{1}{3}$ quarts were taken. How many quarts were left?

16. A man had $5\frac{5}{10}$ acres of land and sold $1\frac{3}{4}$ acres for a house lot. How much did he keep?

17. In a gale a tree top measuring $25\frac{5}{12}$ feet in length was broken off $17\frac{4}{7}$ feet from the ground. What was the height of the tree before the gale?

18. Upon a street a walk was laid $23\frac{1}{2}$ rods in one dircetion and $19\frac{7}{11}$ rods in the opposite direction. What length of walk was laid?

112. We can express the division of $2\frac{1}{2}$ by 10 by writing the dividend above a line and the divisor below it, thus, $\frac{2\frac{1}{2}}{10}$. Fractional numbers so expressed are called **complex fractions.**

113. When the indicated division is done the fraction is said to be *simplified.*

114. Illustrative Example. Simplify $\frac{5\frac{1}{2}}{6}$.

Work: $\frac{5\frac{1}{2}}{6} = \frac{11}{2} \div 6 = \frac{11 \times 1}{2 \times 6} = \frac{11}{12}$ or $\frac{11}{2} \div \frac{12}{2} = \frac{11}{12}$. *Ans.* $\frac{11}{12}$.

Written Exercise

115. Change to common fractions, *i.e.* simplify:

1. $\frac{7\frac{1}{2}}{10}$	**7.** $\frac{10}{7\frac{1}{2}}$	**13.** $\frac{1\frac{2}{3}}{10}$	**19.** $\frac{62\frac{1}{2}}{100}$	**25.** $\frac{50}{6\frac{1}{4}}$
2. $\frac{2\frac{3}{4}}{4}$	**8.** $\frac{1\frac{2}{3}}{8}$	**14.** $\frac{7\frac{3}{10}}{\frac{3}{4}}$	**20.** $\frac{87\frac{1}{2}}{100}$	**26.** $\frac{87\frac{1}{2}}{6\frac{1}{4}}$
3. $\frac{8\frac{1}{3}}{16\frac{2}{3}}$	**9.** $\frac{33\frac{1}{3}}{\frac{3}{4}}$	**15.** $\frac{16\frac{2}{3}}{20}$	**21.** $\frac{33\frac{1}{3}}{100}$	**27.** $\frac{100}{8\frac{1}{3}}$
4. $\frac{3}{7\frac{1}{2}}$	**10.** $\frac{5\frac{2}{5}}{\frac{1}{2}}$	**16.** $\frac{6\frac{2}{3}}{\frac{4}{5}}$	**22.** $\frac{66\frac{2}{3}}{100}$	**28.** $\frac{18\frac{3}{4}}{100}$
5. $\frac{1}{6\frac{1}{4}}$	**11.** $\frac{3\frac{1}{4}}{4\frac{1}{2}}$	**17.** $\frac{8\frac{1}{3}}{3\frac{1}{3}}$	**23.** $\frac{16\frac{2}{3}}{150}$	**29.** $\frac{37\frac{1}{2}}{25}$
6. $\frac{\frac{3}{4}}{\frac{2}{3}}$	**12.** $\frac{\frac{2}{5}}{\frac{4}{7}}$	**18.** $\frac{\frac{5}{6}}{\frac{2}{7}}$	**24.** $\frac{\frac{2}{3}}{\frac{4}{5}}$	**30.** $\frac{2\frac{2}{15}}{5\frac{1}{5}}$

31. The rent of a house per month of 30 days was \$$62\frac{1}{2}$. What was the rent for 1 day?

32. A train on the Pennsylvania Railroad had a run of $75\frac{4}{5}$ miles in 64 minutes. What was the distance run per minute?

Oral Exercise

116. To find what part one number is of another.

What part of 6 days are 2 days? What part are 4 days?

SOLUTION. 1 day is $\frac{1}{6}$ of 6 days; 2 days are $\frac{2}{6}$, or $\frac{1}{3}$, of 6 days; 4 days are $\frac{4}{6}$, or $\frac{2}{3}$, of 6 days.

What part of:

	a	*b*	*c*	*d*	*e*
1.	\$9 is \$3?	6 is 2?	10 is 2?	8 is 2?	20 is 5?
2.	\$9 is \$6?	6 is 4?	10 is 6?	7 is 4?	40 is 8?
3.	9¢ is 5¢?	6 is 5?	10 is 8?	9 is 6?	40 is 16?

To find what part one number is of another, we make the number which is a part the numerator of the fraction and the number with which it is compared the denominator.

4. In a family of 9, 2 are parents, 5 are children, 2 are servants. The parents are what part of the family? The children are what part? The servants are what part?

5. Three of the children are at home, the rest are at school. What part are at home? What part are at school?

6. The wages of a man servant of the family are \$30 a month; of a maid, \$20. The maid's wages are equal to what part of the man's wages?

7. If the head of the family earns \$400 a month, what part of this is paid to the servants?

8. If the 3 girls have \$1$\frac{1}{2}$ each a week for doing housework, and if the 2 boys have \$2 each a week for tending fires and doing the chores, how much do the 5 children earn? What part of this does each boy earn? What part do the 3 girls earn? What part does 1 girl earn?

Oral or Written Exercise

117. 1. A score is 20. What part of a score is 1 dozen? $\frac{1}{3}$ dozen?

2. What part of an hour are 5 minutes? 25 minutes?

3. A man failing in business can pay but 40¢ on a dollar of what he owes. What part is this of $1? What can he pay on a debt of $500?

4. A necktie that costs 50¢ sells for 60¢. How much is the gain? This is what part of the cost?

5. When berries that cost 30 cents sell for 24 cents, what part of the cost is the money that is lost?

6. What part of a working day of 10 hours are 8 hours?

7. When 4 hours are dropped from the 48 hours of a week's work, what part of the length of a week's work is dropped? What part of his former working time is a man then employed?

8. At the rate of $10 rent on $100 of value, what rent is charged on a house valued at $2500?

9. When storage is charged at the rate of $1 a month for 30 square feet on the floor, how much is the rent per month of a room having 125 square feet on the floor?

10. Mr. Swift sold a horse for $300 that cost him $800. What part of the cost of the horse was his loss?

11. If he had sold the horse for $1500, what part of the cost would he have gained?

12. A train conductor runs daily from M—— to C——, 210 miles. What part of his daily run has been completed when he reaches F——, a distance from M—— of 90 miles? When he reaches L——, a distance from M—— of 147 miles?

Written Exercise

118. Illustrative Example. — What part of $\frac{3}{4}$ is $\frac{2}{5}$?

WORK

$$\frac{\frac{2}{5}}{\frac{3}{4}} = \frac{12}{20} \div \frac{15}{20} = \frac{12}{15} = \frac{4}{5}$$

EXPLANATION: Making the part $\frac{2}{5}$ the numerator and $\frac{3}{4}$, with which it is compared, the denominator, we have a complex fraction, which simplified equals $\frac{4}{5}$. [See also Art. 107.] *Ans.* $\frac{4}{5}$.

What part of

1. $\frac{5}{8}$ is $\frac{1}{3}$?
2. $\frac{3}{8}$ is $\frac{2}{5}$?
3. $\frac{5}{6}$ is $\frac{3}{5}$?
4. $\frac{7}{8}$ is $\frac{3}{4}$?
5. $\frac{7}{10}$ is $\frac{7}{20}$?
6. $\frac{3}{5}$ is $\frac{1}{4}$?
7. $\frac{5}{4}$ is $\frac{3}{8}$?
8. $3\frac{1}{3}$ is $\frac{4}{5}$?

In example 8, first change $3\frac{1}{3}$ to thirds.

9. $5\frac{1}{3}$ is 4?
10. $8\frac{1}{3}$ is 2?
11. 18 is $4\frac{1}{2}$?
12. 11 is $4\frac{2}{3}$?
13. $16\frac{2}{5}$ is $12\frac{1}{2}$?
14. $33\frac{1}{3}$ is $6\frac{1}{4}$?

15. Bert has 9 rows of corn to hoe. What part of his work will be done when he has hoed $1\frac{1}{2}$ rows? When he has hoed $7\frac{1}{2}$ rows?

16. Compare the age of Frank, who is $1\frac{1}{4}$ years old, with the age of his mother, who is 25 years old. What part of his mother's age is his age?

17. Compare the age of Frank's mother with the age of his father, who is $31\frac{1}{4}$ years old. What part of his father's age is his mother's?

18. Compare his father's age with Frank's age and tell how many times as old as Frank his father is.

19. Of a school day of $5\frac{1}{2}$ hours 20 minutes are taken for recesses, 45 minutes are taken for drawing, 35 minutes are taken for reading and 15 for gymnastics. What part of the school day is taken for recesses? for drawing? for reading? for gymnastics?

Oral or Written Exercises

119. To find the whole when a part is given.

Illustrative Example. If $\frac{4}{9}$ of a yard is 16 inches, how many inches are there in a yard?

Work

$$\frac{\cancel{16} \times 9}{\cancel{4}} = 36.$$

Solution. Since $\frac{4}{9}$ yd. = 16 in., $\frac{1}{9}$ yd. = $\frac{1}{4}$ of 16 in. = 4 in. $\frac{9}{9}$ yd. = 9 times 4 in. = 36 in. *Ans.* 36 in.

1. I am thinking of a coin; $\frac{2}{5}$ of its value is 40¢. What is its full value?

2. $\frac{3}{4}$ ton of coal occupies 24 cubic feet. How many cubic feet will 1 ton occupy?

3. What is the cost of 1 yard of cloth if $\frac{2}{3}$ yard costs 60 cents? If $\frac{5}{4}$ yard costs 60 cents?

Find the price per dozen:

4. When $\frac{5}{6}$ dozen peaches sell for 15 cents.

5. When $\frac{3}{5}$ dozen eggs sell for 15 cents.

6. When $\frac{2}{3}$ dozen spools of cotton sell for 20 cents.

7. When $\frac{5}{8}$ dozen marbles sell for 10 cents.

8. When $1\frac{1}{2}$ dozen oranges sell for 36 cents.

9. A 25-cent piece is about $\frac{5}{4}$ of the value of a French franc. What is the value of a French franc?

10. In $\frac{3}{8}$ of a quire there are 9 sheets. How many sheets are there in a whole quire?

11. There are $\frac{6}{5}$ as many sheets in a quire as there are quires in a ream. How many quires are there in a ream?

12. If a bushel of oats weighing 40 pounds is $\frac{8}{11}$ as heavy as a bushel of turnips, what is the weight of a bushel of turnips?

Oral Exercise

120. 1. If a family uses $2\frac{1}{2}$ quarts of milk in a day, how many quarts will it use in a week?

2. How much will 3 lb. of meat cost at $15\frac{1}{2}¢$ a pound?

3. How much will 9 cords of wood cost at $\$6\frac{1}{4}$ a cord?

4. My chamber is 9 feet long and $8\frac{1}{3}$ feet wide. How many square feet are there in the floor?

5. How far is it around a square tract of land that measures $\frac{7}{8}$ of a mile on each side?

6. If a plan of a yard is drawn so that $\frac{1}{10}$ of an inch represents 1 foot in length, how many inches represent 45 feet?

7. If I sold 72 lb. of old iron for $\frac{1}{4}¢$ per pound, and 64 lb. of old newspapers at $\frac{1}{2}¢$ per pound, how much did I receive for the lot?

8. I paid $\$2$ for a half dozen photographs. What should I pay for 40 at the same rate?

9. What must be paid for 8 hats at $75¢$ each?

10. A dealer sold 10 pairs of shoes at $\$1.12\frac{1}{2}$ a pair. How much should he receive for them?

11. At 2 for a quarter dollar, how many handkerchiefs can I buy for $\$2.00$?

12. May 1, 1907, Mrs. Smith bought a piano for $\$250$, for which she agreed to pay $\$10$ a month till the debt should be canceled. What should be the date of the last payment?

13. A dealer in old junk paid $12\frac{1}{2}¢$ for 20 old bottles. How much was this per bottle?

14. The storage on a lot of furniture at $\$\frac{1}{4}$ per month was $\$2\frac{1}{20}$. Find the time it was stored.

Written Exercise

121. **1.** A house worth $7850 was insured for $\frac{3}{4}$ of its value. What would be the owner's loss should it be burned down?

2. It will require $5.62\frac{1}{2}$ to replace a broken vase which cost $4.50. What part of the present outlay was the first cost?

3. Mr. Sprague's income is $4200 a year. His household expenses are $\frac{5}{7}$ of his income; if he spends $\frac{1}{3}$ of the remainder in travel, and gives $\frac{1}{8}$ to an invalid relative, how much remains?

4. My fish bill for July was as follows: $4\frac{1}{2}$ lb. of haddock at 15¢ a pound, $1\frac{3}{4}$ lb. of halibut at 25¢ a pound, and 2 butter fish at 20¢ each. I gave in payment a $2 bill. What change should I receive?

What is the amount of the following purchases:

5. 3 tubs of butter containing 35 lb. at 25¢, 1 tub containing 44 lb. at $37\frac{1}{2}$¢, and 30 pounds at 32¢?

6. 2 boxes of cheese each containing 75 lb. at $12\frac{1}{2}$¢, and 1 box of 82 pounds at $16\frac{2}{3}$¢?

7. 1 quarter of beef weighing 190 pounds at $6\frac{1}{4}$¢, and 1 quarter weighing 210 pounds at $8\frac{1}{3}$¢?

8. 60 yards of linen at $62\frac{1}{2}$¢ a yard; 54 yards of silk at 75¢ a yard, and 36 yards at $87\frac{1}{2}$¢?

9. 18 yards of velvet at $\$1.33\frac{1}{3}$; 25 yards at $1.50; 22 yards at $\$1.66\frac{2}{3}$?

10. Mr. Bellows owned $\frac{5}{8}$ of $\frac{2}{3}$ of $\frac{1}{2}$ of a schooner that was sold for $12,730. What was his share of the price?

11. $426 \times 15\frac{2}{3} = ?$ **13.** $521 \times 12\frac{1}{2} = ?$ **15.** $186 \times 6\frac{1}{4} = ?$

12. $262 \times 62\frac{1}{2} = ?$ **14.** $482 \times 37\frac{1}{2} = ?$ **16.** $216 \times 33\frac{1}{3} = ?$

Oral or Written Exercise

122. 1. 2 is what part of 20? $2\frac{1}{2}$ is what part of 10? Numbers that are contained a whole number of times in a given number are called **aliquot parts** of the number. 2 and $2\frac{1}{2}$ are aliquot parts of 10.

		a	*b*	*c*	*d*	*e*
2.	What part of 10 is	5?	$2\frac{1}{2}$?	$7\frac{1}{2}$?	$3\frac{1}{3}$?	$6\frac{2}{3}$?
3.	What part of 100 is	10?	20?	40?	60?	80?
4.	What part of 100 is	50?	25?	$12\frac{1}{2}$?	$6\frac{1}{4}$?	75?
5.	What part of 100 is	$37\frac{1}{2}$?	$62\frac{1}{2}$?	$87\frac{1}{2}$?	125?	$112\frac{1}{2}$?
6.	What part of 100 is	$33\frac{1}{3}$?	$66\frac{2}{3}$?	$16\frac{2}{3}$?	$83\frac{1}{3}$?	$8\frac{1}{3}$?

123. Illustrative Examples. Find the cost of 72 hats (1) at 50¢ each; (2) at 25¢ each; (3) at $1.25 each.

WORK

(1) 36
2)72

(2) 18
4)72

SOLUTION. 72 hats at $1 each cost $72.

(1) At 50¢ each, 72 cost one half of $72, which is $36.

(1) *Ans.* $36.

(2) At 25¢ each, 72 hats cost one fourth of $72, which is $18.

(2) *Ans.* $18.

(3) At $1.25 each, 72 hats cost $72 + $18 = $90.

(3) *Ans.* $90.

Find the cost of 4 doz. pairs of socks at:

7. 50¢ a pair
8. 25¢ a pair
9. $12\frac{1}{2}$¢ a pair
10. 75¢ a pair
11. $33\frac{1}{3}$¢ a pair
12. $8\frac{1}{3}$¢ a pair
13. $16\frac{2}{3}$¢ a pair
14. $66\frac{2}{3}$¢ a pair
15. $\$1.33\frac{1}{3}$ a pair
16. $1.25 a pair
17. $1.50 a pair
18. $\$1.12\frac{1}{2}$ a pair
19. $\$1.37\frac{1}{2}$ a pair
20. $\$1.62\frac{1}{2}$ a pair
21. $\$1.87\frac{1}{2}$ a pair

Written Exercise

124. 1. I paid \$36.40 for $5\frac{1}{5}$ tons of coal. What was the price per ton?

2. I paid \$27 for furnace coal at $\$6\frac{3}{4}$ a ton. How many tons did I buy?

3. If \$56.27 is paid for $8\frac{1}{2}$ tons of egg coal, what is the price per ton?

4. The diameter of a wheel is about $\frac{7}{22}$ of its circumference. What is the circumference of a wheel whose diameter is 112 inches?

5. A member of a committee was $\frac{2}{5}$ of an hour late. The loss of $\frac{2}{5}$ hour to each member of the committee caused the total loss of $5\frac{1}{5}$ hours. What was the number of the committee?

6. $\frac{1}{3}$ of an estate of \$15,430 is given to the mother of two children between whom the rest of the estate is equally divided. How much does the mother have? What is the share of each child?

7. A month's rent for a store is $\$33\frac{1}{3}$. How much is a year's rent? How much is the rent for $\frac{4}{5}$ month?

8. A box whose height is 1 foot, length 1 foot, and width 1 foot contains $56\frac{1}{4}$ pounds of powder. How many pounds would be contained in a box of twice this capacity? in a box $\frac{1}{2}$ of this capacity?

9. For the use of \$1580 of borrowed money a man paid $\frac{3\frac{1}{2}}{100}$ of the sum. How much did he pay for it?

10. If \$80 is paid for the use of borrowed money, and this is $\frac{5}{100}$ of the money borrowed, how much was borrowed?

Oral and Written Exercise

125. **1.** If 30 cents is the cost of 3 pecks of oats, what is the cost of 1 peck? of a bushel?

2. 3 quarts of milk cost 18 cents. What is the cost of a gallon?

3. 2 feet of chain cost 8 cents. What is the cost of a yard?

4. 8 buttons cost 16 cents. What is the cost of 1 dozen?

5. 15 is $\frac{3}{4}$ of a score. How many ones equal a score?

6. When $\frac{2}{3}$ of a dozen eggs cost 10 cents, what is the price per dozen? of $1\frac{1}{3}$ dozen?

SOLUTION. (1) When $\frac{2}{3}$ of a dozen cost 10 cents, $\frac{1}{3}$ dozen costs $\frac{1}{2}$ of 10 cents, which is 5 cents, and $\frac{3}{3}$, or a whole dozen, costs 3 times 5 cents, which is 15 cents.

(2) $1\frac{1}{3}$ dozen $= \frac{4}{3}$ dozen; $\frac{4}{3} = 2 \times \frac{2}{3}$; hence $1\frac{1}{3}$ dozen will cost $2 \times 10¢ = 20¢$.

7. $\frac{3}{5}$ ton of coal cost \$6. Find the cost of 1 ton; of $1\frac{1}{5}$ ton; of $1\frac{4}{5}$ ton; of $2\frac{2}{5}$ tons.

8. $\frac{7}{10}$ rod of fence cost \$21. Find the price per rod. Find the cost of $\frac{7}{5}$ rod; of $2\frac{4}{5}$ rods.

9. $\frac{2}{3}$ yard of satin costs 80 cents. Find the cost per yard. Find the cost of $1\frac{1}{3}$ yards; of $3\frac{1}{3}$ yards.

10. A party lost $\frac{1}{3}$ of their bread, which left them only 12 ounces each per day. What was their previous allowance?

11. By evaporation a lot of fruit lost $\frac{2}{5}$ of its weight. If the lot then weighed 15 pounds, what was its previous weight?

12. Taxes are $\frac{1}{6}$ higher this year than last. This year they are \$14 on a thousand dollars. How much were they last year?

NOTE. \$14 must be $\frac{7}{6}$ of the tax last year.

13. What number increased by $\frac{2}{3}$ of itself equals fifty?

Written Exercise

126. 1. When $\frac{2}{5}$ of a barrel of flour costs \$3, what is the price per barrel?

2. What is the weight of a barrel of pork when $\frac{2}{3}$ of a barrel weighs $133\frac{1}{3}$ pounds?

What is the price per pound:

3. Of salmon, when $1\frac{1}{2}$ pounds cost $37\frac{1}{2}$¢?

4. Of veal cutlets, when $\frac{3}{4}$ of a pound costs $22\frac{1}{2}$¢?

5. Of veal steak, when $3\frac{1}{4}$ pounds cost 65¢?

6. Of beef steak, when $3\frac{1}{2}$ pounds cost \$1.05?

7. Of tenderloin, when $1\frac{7}{8}$ pounds cost 60¢?

8. After losing $\frac{1}{7}$ of his peach trees, a gardener had 138 left. How many peach trees had he at first?

9. For the use of some money for a year I paid \$42. If this was $\frac{6}{100}$ of the money I borrowed, how much did I borrow?

10. If a farmer sells a cart for \$48 and thereby gains $\frac{1}{5}$ of what it cost him, how much did it cost him?

11. John's bicycle cost \$55, which was $\frac{1}{7}$ more than the cost of Harry's. How much did Harry's cost?

12. A farm laborer earns \$3.50 a day in the haying season, which is $\frac{3}{4}$ more than he can earn per day in the spring. What are his daily wages in the spring?

13. When the wages of a man for $\frac{3}{8}$ of a day are $87\frac{1}{2}$¢, how much are they for $\frac{3}{4}$ of a day? for $1\frac{1}{2}$ days?

14. What number diminished by $\frac{1}{10}$ of itself equals 900 dollars?

Oral or Written Exercise

127. 1. Blanche and Harry earned $15 picking berries. Blanche picked 2 quarts to Harry's 1 quart. What part of the money should be paid to Harry? to Blanche? Find how much each should have.

2. John and Charles are two boys who earned $10 together. John worked 2 hours a day; Charles worked 3 hours a day. What part of the money should be paid to John? to Charles? How much should be paid to each?

3. Two miners, A and B, received $63 for the gold they gathered in a week. If A gathered 3 ounces to B's 4 ounces, what part of $63 is A's share? What part is B's share? Find the share of each.

4. If A can saw in 3 days a pile of wood which it takes B 5 days to saw, how long would it take both working together to saw it?

SOLUTION. A can saw $\frac{1}{3}$ of the pile in 1 day; B can saw $\frac{1}{5}$ of it in 1 day. Both working together can saw $\frac{1}{3}+\frac{1}{5}$ of it, or $\frac{8}{15}$ of it, in 1 day: to saw $\frac{15}{15}$, or the whole, would take as many days as there are times $\frac{8}{15}$ in $\frac{15}{15}$, which is $1\frac{7}{8}$ times. *Ans.* $1\frac{7}{8}$ days.

5. A can build a fence in 5 days; B can build it in 6 days; C can build it in 10 days. In what time could A and B working together build it?

6. In what time could B and C working together build it?

7. In what time could A, B, and C working together build it?

8. Mr. Cole pays at the rate of 6 dollars for the loan of $100 for 1 year, and at the rate of 5 dollars for the loan of another $100 for 1 year. For what length of time will he pay $33 for both loans?

Drill Table

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
A	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{10}{11}$	$\frac{3}{5}$	$\frac{7}{12}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{4}{7}$	$\frac{2}{3}$	$\frac{1}{15}$	$\frac{1}{2}$	$\frac{5}{7}$	$\frac{3}{8}$	*A*
B	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{5}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{7}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{1}{9}$	$\frac{2}{5}$	$\frac{3}{7}$	$\frac{3}{5}$	$\frac{5}{8}$	*B*
C	$\frac{11}{24}$	$\frac{19}{20}$	$\frac{11}{15}$	$\frac{11}{21}$	$\frac{13}{30}$	$\frac{11}{24}$	$\frac{11}{14}$	$\frac{11}{32}$	$\frac{11}{36}$	$\frac{11}{21}$	$\frac{11}{45}$	$\frac{13}{15}$	$\frac{11}{21}$	$\frac{11}{42}$	$\frac{19}{48}$	*C*
D	$5\frac{5}{6}$	$4\frac{9}{10}$	$7\frac{1}{3}$	$4\frac{1}{6}$	$6\frac{9}{10}$	$3\frac{1}{3}$	$2\frac{1}{3}$	$1\frac{1}{8}$	$3\frac{1}{2}$	$4\frac{2}{3}$	$6\frac{1}{3}$	$1\frac{1}{3}$	$4\frac{1}{3}$	$4\frac{1}{7}$	$3\frac{1}{4}$	*D*

Exercises on the Table

128. In each of the columns 1, 2, 3, etc.,

1–15. Add *A* and *B*.

16–30. Add *B* and *C*.

31–45. Add *C* and *D*.

46–60. Add *A*, *B*, and *C*.

61–75. Add *B*, *C*, and *D*.

76–90. Add *A*, *B*, *C*, and *D*.

91–105. Take *C* from *D*.

106–120. Take *B* from *D*.

121–135. Take $B + C$ from *D*.

136–150. Find *A* of 1260.

151–165. Find *B* of 2520.

166–180. Find *C* of 20,160.

181–195. Find *D* of 840.

196–210. Multiply *A* by *B*.

211–225. Multiply *B* by *C*.

226–240. Multiply *D* by *C*.

241–255. Multiply *D* by $2\frac{1}{2}$.

256–270. Divide *C* by *B*.

271–285. Divide *D* by 3.

286–300. Divide *A* by *B*.

301–315. Divide *B* by *C*.

316–330. Divide *D* by *A*.

331–345. $C = \frac{3}{8}$ of what?

346–360. $D = \frac{8}{9}$ of what?

361–375. $A \times B = \frac{5}{12}$ of what?

376–390. $1\frac{1}{2} \times D = \frac{6}{7}$ of what?

291–405. If it requires the number of days expressed in line *D* for 1 man to do a piece of work, what time would be required for 2 men to do it?

406–420. Each number in *A* is $\frac{2}{3}$ of what number?

Review pages 7 to 9.

129. 1. Read the fractions .5; .05; .055.

2. Write these fractions as common fractions.

Notice that each fraction has for its denominator 10 or a number that can be made by using only 10's as factors. Thus, the denominators, $100 = 10 \times 10$; $1000 = 10 \times 10 \times 10$.

A fraction whose denominator is 10, or a number that can be made by using 10's only as factors, is a **decimal fraction**, or a **decimal**.

130. The manner of writing decimals with whole numbers is shown in the following:

TABLE

Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Units (ones)	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths	Millionths
4,	4	4	4,	4	4	4.	4	4	4,	4	4	4

3. Give the name of the place occupied by the first figure at the left of ones; at the right; by the second figure at the left of ones; at the right; by the third figure at the left; at the right; by the sixth figure at the left; at the right.

4. What is the name of the second place at the right of the point? of the fourth place? of the third? of the fifth? of the sixth?

Numbers extend indefinitely, from millions to ten-millions, hundred-millions, billions, ten-billions, hundred-billions; from millionths to ten-millionths, hundred-millionths, billionths, ten-billionths, hundred-billionths, and so on.

Oral and Written Exercises

131. 1. Write 6 in thousandths' place, filling other places to the point with zeros. In the same way write 6 hundredths; 66 thousandths; 666 millionths.

2. Write as one number 3 tenths, 6 hundredths, 9 thousandths. Read the number you have just written.

In the same way write, then read:

3. 4 tenths, 0 hundredths, 8 thousandths, 2 ten-thousandths.

4. 0 tenths, 9 hundredths, 4 thousandths, 6 ten-thousandths, 7 hundred-thousandths.

5. 3125 ones, 3 hundredths, 1 thousandth, 2 ten-thousandths, 5 hundred-thousandths:

Example 5 is written, 3125.03125; it is read 3,125 *and* 3,125 hundred-thousandths.

132. A whole number with a decimal is called a **mixed decimal.**

We read a decimal as we read a whole number, giving it the name of the place of its right-hand figure.

133. In reading a mixed decimal we use the word *and* before the decimal.

Read, or write in words, the following:

6. 404.6	11. 0.2714	16. 185.001	21. 0.06007
7. 0.648	12. 50.625	17. 16.407	22. 0.404
8. 0.098	13. 0.0027	18. 0.0906	23. 400.004
9. 27.35	14. 4.1041	19. 100.1	24. 73.06
10. 1.875	15. 13.002	20. 0.7809	25. 1500.1005

Written Exercise

134. Illustrative Example. (1) Write 9 hundred 6 thousandths; (2) write 9 hundred *and* 6 thousandths.

WORK (1) 0.906; (2) 900.006.

We write a decimal so that its right-hand figure shall be in the place that has the same name that the decimal has.

Write in figures the following:

1. Eight, and sixty-three thousandths.
2. Five hundred eighty-five ten-thousandths.
3. Two hundred six thousandths; 200 and 6 thousandths.
4. 118 ten-thousandths; 100 and 18 ten-thousandths.
5. Five thousand two hundred sixteen hundred-thousandths.
6. Twenty-six and three hundred seventeen millionths.
7. Three hundred, and seventeen millionths.
8. Nine, and one hundred eight millionths.
9. Eighteen, and two ten-thousandths.

Write the following in decimal form:

10. $8\frac{9}{10}$; $\frac{45}{100}$; $1\frac{85}{100}$; $3\frac{8}{100}$; $6\frac{5}{1000}$; $\frac{60}{100}$; $\frac{10}{10000}$.

Copy and fix the decimal point in the following: so that

11. 8, 35, 607, 4342 shall each express *tenths*.
12. 25, 862, 1258 shall each express *hundredths*.
13. 89, 547, 11333 shall each express *thousandths*.
14. 6, 26, 666, 13333 shall each express *ten-thousandths*.
15. 7, 84, 6749, 97531 shall each express *millionths*.
16. 875, 9864, 78 shall each express *hundred-thousandths*.

Written Exercise

135. Illustrative Examples. Change each of the decimals .25, $.33\frac{1}{3}$, .625 to a common fraction in its smallest terms.

WORK $.25 = \frac{25}{100} = \frac{1}{4}$; $.33\frac{1}{3} = \frac{33\frac{1}{3}}{100} = \frac{100}{300} = \frac{1}{3}$; $.625 = \frac{625}{1000} = \frac{5}{8}$

To change a decimal to a common fraction in its smallest terms, we write the decimal as a common fraction and strike out the common factors in its terms.

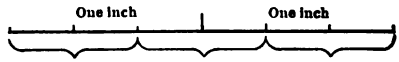
Change to common fractions in their smallest terms:

1.	.75	5.	.375	9.	.05	13.	$.3\frac{1}{3}$	17.	1.25
2.	.80	6.	.625	10.	.15	14.	$.33\frac{1}{3}$	18.	1.625
3.	.125	7.	.1875	11.	.375	15.	$.16\frac{2}{3}$	19.	$3.33\frac{1}{3}$
4.	.875	8.	.3125	12.	.75	16.	$.14\frac{2}{7}$	20.	$1.66\frac{2}{3}$

136. To change a common fraction to a decimal.

Compare $\frac{3}{4}$ of 1 inch with $\frac{1}{3}$ of 2 inches.

ILLUSTRATION.



$\frac{1}{3}$ of 2 inches = $\frac{3}{4}$ of 1 inch.

Illustrative Example. Change $\frac{5}{8}$ to a decimal.

WORK

$$8\overline{)5.000}$$
$$.625$$

EXPLANATION. Since $\frac{5}{8} = \frac{1}{8}$ of 5, we change 5 to 5.0 and divide by 8. $\frac{1}{8}$ of 5.0 = .6 with .2 undivided; .2 = .20; $\frac{1}{8}$ of .20 = .02 with .04 undivided; .04 = .040; $\frac{1}{8}$ of .040 = .005.

Ans. .625.

To change a common fraction to a decimal, we annex zeros to the numerator and divide by the denominator.

Change to decimals not beyond 3 places:

21.	$\frac{3}{8}$	23.	$\frac{2}{7}$	25.	$\frac{3}{20}$	27.	$\frac{5}{16}$	29.	$\frac{5}{6}$	31.	$\frac{7}{9}$	33.	$\frac{11}{12}$
22.	$\frac{2}{3}$	24.	$\frac{3}{5}$	26.	$\frac{6}{5}$	28.	$\frac{9}{8}$	30.	$\frac{13}{5}$	32.	$\frac{7}{11}$	34.	$\frac{8}{15}$

Oral and Written Exercise

137. The units of United States Money are shown in the following:

TABLE OF UNITED STATES MONEY

10 mills = 1 cent
10 cents = 1 dime
10 dimes = 1 dollar
10 dollars = 1 eagle

Review Art. 9, page 9

1. Repeat the table of United States Money. The dollar is the unit with which the other units are compared, and is called the **primary unit.**

2. 1 eagle equals how many dollars? Express in figures.

3. What part of $1 is 1 dime? Express in figures.

4. What part of 1 dime is 1 cent? Express in figures.

5. What part of 1 dollar is 1 cent? Express in figures.

Read the following as dollars and decimals of a dollar:

6. $5.6
7. $24.3
8. $127.06
9. $200.42
10. $111.11
11. $404.04
12. $10.87½
13. $459.37½

14. Read the above as dollars and cents.

15. In examples 12 and 13 express the half cents in decimals, then read the examples as dollars and thousandths.

Read the following as dollars, cents, and mills:

	a	*b*	*c*	*d*	*e*
16.	$5.793	$0.375	$36.083	$97.12½	80\frac{64}{100}$
17.	$8.206	$40.109	$806.470	$400.87½	1904\frac{25}{1000}$

Read the above as dollars and cents and decimals of cents.

Write the following in decimal form:

18. $50, 36 cents
19. $18, 62 cents, 5 mills
20. 6 cents, 6 mills
21. 625 cents
22. 98 cents
23. 412½ cents
24. 196¢
25. 60½¢
26. 9467¢

Written Exercise

Review pages 12 and 13

138. Illustrative Example. Write in column and add 28.7, 475.28, .43, 25.345, 927.729.

WORK

122 11 (carryings)

28.7
475.28
.43
25.345
927.729
1457.484

EXPLANATION. To add decimals we write them, units of the same order in the same column, and, beginning with the lowest order, add as we add in whole numbers.

Read, write, and add:

1. .97; 8.081; .347; .08; 54.54; .466; 500.062.

2. 80.56; 913.853; .008; 300.44; .338; 364.6; .131.

3. 84.071; 67.809; 100.05; 726.36; 75.067; 7055.902; 203.209.

4. 9 hundred, and 67 thousandths; 9 hundred 67 ten-thousandths; 5 thousand 908 ten-thousandths; 5 thousand 9 hundred, and 8 ten-thousandths.

139. Illustrative Example. From 92.5 subtract 16.43.

WORK

92.50
16.43
76.07

EXPLANATION. As there are no hundredths in 92.5, we think of 1 of the .5 as changed to 10 hundredths; .03 from .10 leaves .07; .4 from .4 which remain, leaves no tenths; 6 (ones) from 12 (ones) leaves 6 (ones); 1 (ten) from 8 (tens) which remain, leaves 7 tens. *Ans.* 76.07.

1. A man who had in the bank $138.18 paid out $124.39. How much remained?

2. I have in the bank to-day $80.36; yesterday I had $50.80. Find the difference.

Written Exercise

140. **1.** From 707.703, Subtract 129.124

2. From 4.075, Subtract 2.439

3. From 75.09, Subtract 7.446

4. 10.066 − 8.759

5. 908.02 − 87.709

6. 28.06 − 18.803

7. 70. − 6.9872

8. 80. − 9.12345

9. 5. − 2.136

Find how much money remains if

	10.	11.	12.	13.
I have	$16.65	$23.54	$74.96	$232.10
and spend	7.36	8.26	35.39	156.88

14. What is the value in United States money of 1 franc, French money, worth $.193, of 1 pound English money worth $4.8665, and a Swedish crown worth $.268?

15. If water covers .734 of the earth's surface, how much of the surface is land?

16. When .087½ of a debt is paid, how much of it remains to be paid?

17. The equatorial diameter of the earth is 7926.5 miles; the polar diameter is 7899.7 miles. Which is greater? How much?

18. 1 pound of unwashed wool contains .6877 of impurities. How much wool remains after the impurities are removed?

19. Mr. A owns three lots of land of the following sizes, 6.75 acres, 3.124 acres, 8.765 acres. What is the total area of the three lots?

141. Illustrative Examples. (1) Multiply $33 by 10; by 100. (2) Multiply $.333 by 10; by 100; by 1000.

WORK (1) $33 × 10 = $330; $33 × 100 = $3300.
(2) $.333 × 10 = $3.33; $.333 × 100 = $33.3;
$.333 × 1000 = $333.

(1) Notice that each cipher annexed to the figures of a whole number makes each of the figures express 10 times as much as before; also

(2) That each removal of the decimal point to the right has the same effect. Hence,

(1) *To multiply a whole number by* 10, 100, *etc., we annex to the multiplicand at the right as many zeros as the multiplier has zeros.*

(2) *To multiply a decimal by* 10, 100, *etc., we move the decimal point in the multiplicand to the right as many places as the multiplier has decimal places.*

Written Exercise

142. Multiply the following:

1. 15 by 10	6. .738 by 100	11. 60 by 1000
2. 600 by 10	7. 5.82 by 100	12. 1.5 by 1000
3. 4.2 by 10	8. 6.400 by 100	13. 37.54 by 109
4. 4.2 by 100	9. .001 by 100	14. .01 by 1000
5. 6.87 by 10	10. 5.7214 by 100	15. 74.188 by 1000

Multiply and add as in example 16.

16.	17.	18.	19.
.64 × 10 = 6.4	.083 × 1000 =	5.7 × 10 =	9.02 × 100 =
.64 × 100 = 64	.083 × 100 =	5.7 × 1000 =	9.02 × 10000 =
.64 × 110 = 70.4			

Written Exercise

143. Illustrative Examples. (1) Multiply $1.375 by 200. (2) Multiply 1.375 by 2000.

WORK

(1) 1/37.5 prod. by 100
200
275.0 prod. by 200

(2) 1/375.
2000
2750

EXPLANATION. (1) The multiplication of 1.375 by 200 is expressed by moving the decimal point two places to the right, thus, $137.5, and then multiplying this product by 2. (1) *Ans.* $275.

(2) The multiplication of 1.375 by 2000 is expressed by moving the decimal point 3 places to the right; and then multiplying by 2. (2) *Ans.* $2750.

Multiply:

1. $8.50 by 60	5. .6¼ by 600	9. 55.957 by 200
2. $0.42 by 50	6. .10⅕ by 300	10. 70.5 by 4000
3. $0.87½ by 80	7. 1.83⅓ by 900	11. .281 by 7000
4. $1.33⅓ by 30	8. .625 by 2000	12. .1125 by 4200

WORK OF EXAMPLE 12

.1125
11.25 prod. by 100
4200
22.50 prod. by 200
450. prod. by 4000
472.50 prod. by 4200

EXPLANATION. To multiply .1125 by 4200, we may first multiply by 100, which we express by moving the decimal point two places to the right, and then multiply this product by 42.

In practice, we multiply a decimal by a whole number as we multiply a whole number, and then point off as many places in the product as the multiplicand has decimal places.

13. Multiply 8.524 by 230 and by 460 and add the products.

Written Exercise

144. Multiply:

1. 203.24 by 810	4. 6.7062 by 67	7. 426.60 by 39
2. 56.91 by 63	5. .004 by 3200	8. 3742.5 by 730
3. .278 by 4500	6. .837 by 8800	9. 4.68 by 80800

145. Illustrative Example. Multiply \$12.50 (1) by .1; (2) by .01; (3) by .001.

WORK

(1) \$12.50 × .1 = \$1.25
(2) 12.50 × .01 = .125
(3) 12.50 × .001 = .0125

EXPLANATION. To multiply by .1 is to take 1 tenth of a number, or to divide by 10; to multiply by .01 is to take 1 hundredth of a number or to divide by 100, and so on.

Notice that each removal of the decimal point one place to the left makes all the figures express 1 tenth as much as before. Hence,

To multiply a decimal by .1, *we move the decimal point one place to the left; to multiply by* .01 *we move the point two places to the left; and so on.*

If there are not decimal places enough, we prefix zeros to the figures of the multiplicand.

Multiply:

10. 41.8 by .1	14. 37.50 by .01	18. 388.5 by .001
11. 1.8 by .1	15. 465 by .01	19. 21.15 by .001
12. 0.37 by .1	16. 0.83 by .01	20. .005 by .001
13. 0.09 by .1	17. 1.48 by .01	21. 1.16 by .001

22. For the loan of \$500 for 22 months and 6 days, a man was paid a sum equal to .1 of \$500 + .01 of \$500 + .001 of \$500. Find how much he was paid in all.

Written Exercise

146. Illustrative Example. Multiply 42.7 by .08.

WORK

.42/7
/08
3.416

EXPLANATION. To multiply 42.7 by .08 is to take .08 of 42.7. We express the multiplication by .01 by moving the decimal point in the multiplicand two places to the left, thus, .427; then we multiply by 8; the product is 3.416. *Ans.* 3.416.

Notice that the product has as many decimal places as the multiplicand and multiplier together.

In practice, we multiply decimals as we multiply whole numbers, and point off as many places in the product as there are in both multiplicand and multiplier together.

Multiply:

1. 14 by .09	5. 316 by .03	9. 684 by .0005
2. 91.4 by .08	6. 128.5 by .004	10. 2.93 by .006
3. 38.7 by .07	7. .467 by .002	11. 2.973 by .0009
4. 8.75 by .04	8. 6.002 by .08	12. .0294 by .65

WORK AND PROOF OF EXAMPLE 12

(1)	(2)	(3)
.0294	.65	.0294
.65	.0294	.65
1470	260	1764
1764	585	1470
.019110	130	.019110
	.019110	

EXPLANATION. The pupil can prove his multiplication by using the multiplicand as a multiplier, as in (2).

He should have practice in multiplying first by the higher order of units, as in (3). The process is called **Reversed Multiplication.** He may practice this as a test of his work.

13. Multiply 10.078 by .027 and prove.

Written Exercise

147. Multiply:

1. 9 by .2; by .02
2. 9 by .05; by .005
3. 12 by .6; by .08
4. 12 by .008
5. 25 by 1.2; by .12
6. 106 by .3
7. 25 by .012
8. 5005 by .001
9. 46 by .095
10. .14 by 9; by .9
11. .014 by .9; by .09
12. 11.6 by 4
13. 1.16 by 7
14. 17.07 by 11
15. 106 by .3
16. 20 by 1.71
17. 1.12 by .08
18. 30.2 by 1.4
19. 60.37 by 2.6
20. 8.75 by 2.04
21. 3.04 by .105
22. .437 by .045
23. 88.04 by 36
24. .325 by .018
25. .0101 by 4.16
26. 3.007 by .005
27. 66.66 by .0003
28. 6.002 by 2.08
29. 10.00 by .375
30. 1.463 by 1.01
31. 6.002 by 2.08
32. 7.7034 by .0002
33. .1463 by 7.65

34. What is the distance around a square that measures 9.5 feet on a side?

35. An English pint of water weighs 1.25 pounds, and occupies 34.66 cubic inches. A gallon of water weighs how much? It contains how many cubic inches?

36. A cubic inch of statuary marble weighs .098 of a pound. How many cubic inches are there in a block which weighs 12.5 pounds?

37. Water weighs 62.5 pounds to the cubic foot. Granite is 2.72 times as heavy as water. What is the weight of a cubic foot of granite? of 3.2 cubic feet?

38. How many more square feet has a grass plot 50.9 feet square than a plot 100.1 feet long and 25.9 feet wide?

Written Exercise

...THE RATES...
... FOR ...
"WANT" ADS

No. 1

"Eagle Want" Ads set in solid agate cost ½ cent a word. No Ad taken for more than one day for less than 7 cents per day. Ads ordered for alternate days, double price.

No. 2

"Eagle Want" Ads set in all agate, cap display and paragraph lines, cost at rate of 60 cents per inch per issue.

No. 3

"Eagle Want" Ads set in black-face display, with borders and cuts, cost at rate of $1.00 per inch per issue.

148. 1. Examine the rates here given and tell how much an advertisement will cost set in solid agate (No. 1), consisting of 44 words, to run for 10 days.

2. What is the cost of an advertisement set in all agate, cap display and paragraph lines (No. 2), 3 inches long, and for 6 issues?

3. What is the cost of an advertisement set in black-face type with borders (No. 3) and cuts, $4\frac{1}{2}$ inches long, and for 12 issues?

4. Which is cheaper, and how much, to run for 10 issues, an advertisement set all agate, cap display and paragraph lines (No. 2), 5 inches long, or an advertisement set in black-face type with borders and cuts (No. 3), 3 inches long?

5. Make up other similar problems.

6. The June, 1908, number of *Good Housekeeping Magazine* had 39 full-page advertisements at $225 per page, 35 half-page at $112.50 each, $59\frac{1}{4}$ quarter-page at $56.25 each, and 8 pages of small advertisements at $1.25 per agate line, reckoning 14 lines to the inch, 8 inches per column, and 2 columns per page. Find its income from advertisements for the month. At that rate per month, what would be the yearly income from advertisements?

Written Exercise

149. 1. A ticket from Boston to the island of Jamaica is $45. A round-trip ticket is sold for 15 cents less on a dollar than 2 single tickets. How much does a round-trip ticket cost?

2. It takes 1.5 hours for a passenger train to run from H to B, a distance of 60 miles. What is the rate per minute? per hour?

3. A train leaves S at 7:45 P.M. and arrives at A at 5:15 A.M. What is the running time? The distance is 110 miles. What is the rate per hour?

4. The steamboat fare from C to B is $2.00, the stateroom $1.50, two meals, 75¢ each. What is the cost of the trip?

5. The fare one way from D to H is $3.75. A round-trip ticket is $6.50. How much is saved on 25 round-trip tickets?

6. If a railway line is 250 miles long and it cost an average of $23,000 per mile to build it, what was the total cost of building?

7. If the above line requires 54 engines at a cost of $12,000 each, what is the cost of the engine equipment?

8. The regular fare one way from Springfield, Massachusetts, to Chicago, Illinois, is $29.75. Find the total expense of an excursion trip at a round-trip rate of one fare and one third, adding the cost of Pullman sleeper $5.50 each way, meals *en route* $8, and room in Chicago, 5 days at $2.75 per day, and 16 meals in Chicago at an average of $1.10 each.

9. London is 393.6 miles by rail from Edinburgh. The trip can be made to Edinburgh and return in 18 hours, including stops amounting to 24 minutes. What is the average speed of the cars per hour while in motion?

Review pages 9, 24, 31.

150. Divide 6 by 2; divide 10 times 6 by 10 times 2; 100 times 6 by 100 times 2.

Multiplying both divisor and dividend by the same number does not alter the quotient.

151. Illustrative Example. (1) Divide \$.192 by 12; (2) by .12.

WORK

(1) $12\overline{).192}$ .016

(2) $\not{12}.\overline{)\not{19}.2}$ 1.6

EXPLANATION. (1) To divide \$.192 by 12 is to take $\frac{1}{12}$ of \$.192; $\frac{1}{12}$ of \$.192 is \$.016. *Ans.* \$.016.

(2) Here we multiply both divisor and dividend by 100, which we express by moving the decimal point in the divisor and in the dividend two places to the right. *Ans.* \$1.60.

To divide a decimal, we divide as in whole numbers. (1) *If the divisor is a whole number, we point off as many places in the quotient as the dividend has decimal places.* (2) *If the divisor is a decimal, we express it as a whole number, and move the decimal point in the dividend as many places to the right as the divisor has decimal places, and point off as many places in the quotient as the changed dividend has decimal places.*

Written Exercise

152. Divide:

1. .025 by 5	5. $11\overline{)112.86}$	9. .5309 ÷ .07
2. .0018 by 6	6. $11\overline{)734.8}$	10. 5.681 ÷ .06
3. .0816 by 4	7. $.7\overline{)3.15}$	11. 86.84 ÷ .9
4. .63 by 7	8. $.08\overline{)864}$	12. 35.40 ÷ .012

13. I hire some money and for its use pay \$.05 on each dollar hired. If I pay \$9.80, how much money do I hire?

14. 5.5 yards equal 1 rod. How many rods are there in 1 mile, which equals 1760 yards?

Written Exercise

153. Illustrative Example. Divide 29.484 by .72.

WORK

$$\begin{array}{r} 40.95 \\ 72.\overline{)29\,48.4} \\ 28\;8 \\ \hline 68\;4 \\ 64\;8 \\ \hline 3\;60 \\ 3\;60 \\ \hline \end{array}$$

EXPLANATION. Here we first move the decimal points two places to the right to express the divisor as a whole number.

Having found the quotient to tenths, we could express the remainder, 36, as a part of the quotient, thus, $\frac{36}{72} = \frac{1}{2}$, making the entire quotient $40.9\frac{1}{2}$. But by annexing a zero to 36, and continuing the division, the entire quotient becomes 40.95. *Ans.* 40.95.

Divide:

1. 91.05 by 15	4. 4.347 by 5.4	7. .895 by 7.16
2. 14.607 by 27	5. 1000 by .1	8. 91.708 by .0908
3. 70.49 by .38	6. 90.09 by .033	9. 4.954 by .23

WORK OF EXAMPLE 9

$$\begin{array}{r} 21.5391\ldots \\ 23.\overline{)4\,95.4} \\ 35 \\ \hline 12\;4 \\ 90 \\ \hline 210 \\ 30 \\ \hline 7 \end{array}$$

EXPLANATION. In example 9, after the division is carried to ten-thousandths, there is still a remainder, and dots are written in the quotient to show that the division is incomplete.

In the work of example 9 only the undivided parts of the dividend, the remainders, are written down, the products by the successive digits of the quotient being subtracted mentally as the dividing proceeds; briefly thus, 49(0) ÷ 23 = 2(0), with 3(0) undivided; 35 ÷ 23 = 1, with 12 undivided; 12.4 ÷ 23 = .5, with .9 undivided; .90 ÷ 23 = .03, with .21 undivided; .210 ÷ 23 = .009, with .003 undivided, and so on.

Divide:

10. 56.84 by .7	13. .172 by 12	16. 3.027 by 2
11. 5.681 by .06	14. 70.32 by .38	17. 90.09 by .071
12. 1.8 by .008	15. 4.357 by 5.1	18. 538.1 by 4.001

Written Exercise

154. Divide, continuing the division to thousandths only:

1. 5278 by 93	4. 8.709 by 7.1	7. 6.438 by .0032
2. 70.96 by 24	5. 9.067 by .062	8. 57.82 by 540
3. 438.5 by .41	6. 436.2 by .53	9. 173.9 by 8200

10. A square rod contains 30.25 square yards. How many times does it contain 5.5 square yards?

11. The square rod contains 272.25 square feet. How many times is 30.25 square feet contained in 1 square rod?

12. A grocer pays \$5.10 for lettuce at 3.4¢ a head, and \$8.36 for onions at 3.8¢ a bunch. How many heads of lettuce does he buy? How many bunches of onions?

13. A bushel of even measure contains 2150.42 cubic inches. Find the number of quarts, each 67.12 cubic inches, in a bushel. How many British quarts, each 69.32 cubic inches, are there?

14. From New York to Cleveland, Ohio, is 568 miles. If the trip is made in 19.5 hours, what is the rate per hour?

15. How much coal at \$3.75 a ton will \$70.50 pay for?

16. At \$.0675 a running yard for laying matting, how many yards can be laid for \$22.50?

17. A horse going at the rate of 7.375 miles an hour will require how many hours to go 20 miles?

18. 15.5 pounds of grain lost 4.5 ounces by drying. What part of its weight did it lose?

19. The circumference of a circle is nearly 3.1416 times its diameter. Find the diameter of a circle whose circumference is 19.635 in.

Written Problems

155. 1. A gallon contains 231 cubic inches. How many times as large is a bushel (2150.42 cubic inches)?

2. A cubic foot of water weighs 62.5 pounds. How many cubic feet are there in 5697.018 pounds?

3. A barrel contains 31.5 gallons. How many barrels are there in a reservoir containing 10,000 gallons?

4. How many times is the product of 2.5 by .07 contained in the product of 76.08 by 9.9?

The report of the health office in Washington, D. C., for 1903, shows the death rate per 1000 of the population in one part of that city as indicated in the margin:

	White	Colored
1894	17.70	30.67
1895	17.74	28.64
1896	17.25	29.54
1897	15.88	28.13
1898	17.16	29.04
1899	17.01	29.94
1900	17.81	30.43
1901	17.17	30.80
1902	15.92	29.13
1903	16.59	28.18
Average		

5. Find the average number of deaths to 1000 of the whites for the ten years; of the colored; of the whole people.

6. Find the excess in the average of colored over that of white people.

7. The average yield of wheat per acre for 1906, in the state of Kansas, was estimated to be 15.09 bushels. If the total number of bushels was 81,830,000, what was the number of acres under cultivation?

8. There are 62.2 cubic inches in 1 quart dry measure. How many cubic inches are there in 1 pint? in 1 gill?

9. A standard bushel contains 2150.42 cubic inches. How many cubic inches are there in 2.5 bushels?

10. If in 2.5 bushels there are 5376.05 cubic inches, how many cubic inches are there in 1 peck?

Written and Oral Exercise

JULY, 1907.	$	¢
Rent	25	00
Milk	5	60
Cream	1	20
Groceries	35	00
Outing	5	20
Medicine		85
Clothing	12	00
Dry Goods	4	76
Assessment	2	50
Books	1	25
Paper, etc.	1	40
Expresses	3	25
Freight	5	25
Hardware	2	00
Fruit	1	00
Laundry	3	00
Postage	1	10
Furniture	23	45
Service	20	00

156. 1. At the right are the items of a family's expenses for July, 1907. Find the total expense.

2. Find the average daily expense.

3. If the family has an income of $225 a month, how much remains after the bills are paid?

4. There are 6 persons in the family. What is the expense for each?

5. What is the expense for the family for the entire year at the same rate?

6. What is the year's expense for each person?

7. Supposing the family income to be $1800 a year, what is the monthly income? How much will the family be in debt at the end of the year, reckoning expenses as in the margin?

8. What part of the whole expense is for groceries? for service? for rent?

9. To make the expenses come within the income, how much could the family afford to spend each month for outings?

10. How much could the family afford for rent, if they decided to economize in that item?

11. Name other items, and tell how much the family could afford to spend on each to have the expenses balanced even with the income.

157. Persons in business record their business transactions, writing down what is owed them and what is paid them by others. A record of such transactions is called an **account.**

158. Items which a person owes are called his **debits [Dr.]**; items which a person pays are called his **credits [Cr.]**.

This is an account of goods, called merchandise, sold to Paul Jones, and of cash given by him in part payment for the goods:

DR. PAUL JONES CR.

1908					1908				
Dec.	1	To merchandise . .	917	83	Dec.	20	By cash .	524	75
"	10	" " . .	192	00	"	25	" " .	211	00
							Balance .	374	08
			1109	83				1109	83

The difference of the two sides of the account is called the **balance** of the account.

To find the balance, we subtract the less side from the greater.

The balance is entered on the less side of the account, and so makes the footings of the two sides equal.

Entering the balance and the footings, and drawing the proper lines, as above, is called **closing the account.**

159. Illustrative Example. Find the balance and close the following account:

DR. PAUL JONES CR.

1908					1908				
Dec.	1	To merchandise . .	917	83	Dec.	20	By cash .	524	75
"	10	" " . .	192	00	"	25	" " .	211	00

Written Exercise

160. Find the balance and close the following accounts:

1. JACOB WEST

19—					19—				
April	1	To merchandise . .	1732	60	April	14	By cash .	1393	55
"	17	" real estate . . .	900		"	17	" " .	500	00

2. ALBERT CANE

19—					19—				
Jan.	1	To merchandise . .	472	65	Jan.	1	By note .	350	00
"	3	" " . .	46	54	"	15	" cash .	175	00
"	10	" " . .	80	19					

3. KNOX AND BURNS

19—					19—				
Aug.	19	To cash .	1480	00	Aug.	19	Real estate . . .	1000	00
					"	19	Span horses . . .	875	

Make and close accounts for the following transactions:

4. STEPHEN STILES

Bought merchandise Oct. 25, $476.84; Nov. 24, $347.49. He paid cash Nov. 1, $387.50.

5. HOMER PRATT

Bought groceries July 5, $676.91. He paid cash Aug. 1, $230.50, and cash Sept. 1, $180.33.

6. Mrs. C. S. Hill bought of W. W. Lothrop & Co., June 24, 1908, 1 Wool Suit, $27.50, 3 Lawn Waists, $1.50 each, 1 Black Taffeta Skirt, $17.50. She paid cash July 1, 1908, $45.00.

161. (Extract from the account book of L. Cook & Co.)

EDWARD PENDLETON, DR.

1907					$	¢
Aug.	10	To 10 bbl. Flour	@ $7.00		70	
"	16	" 25 lb. Raisins	@ 15¢		3	75
"	23	" 30 doz. Eggs	@ 20¢		6	00

The above account after payment, was sent to Edward Pendleton in the following form, which is called a **receipted bill.**

A **bill** is a written statement of what one owes to another.

DAYTON, O., Sept. 1, 1908.

MR. EDWARD PENDLETON,

Bought of L. COOK & Co.

1907				$	¢
Aug.	10	10 bbl. Flour	@ $7.00	70	
"	16	25 lb. Raisins	@ 15¢	3	75
"	23	30 doz. Eggs	@ 20¢	6	00
		Rec'd Payment,		79	75
		L. COOK & Co.			
		per T. Smith.			

162. A bill should contain :

(1) The date on which the bill is made out.

(2) The name of the buyer, who is called the **debtor.**

(3) The name of the person or firm selling the goods, called the **creditor.**

(4) The items sold, with the date, quantity, kind, and price of each, and the amount of the bill.

When the bill is paid, the creditor's name is written after the words Received Payment. The bill then becomes a **receipt.**

Any person authorized to receive the money may receipt by writing the creditor's name, and after it his own name.

NOTE. The teacher should show how to receipt the above bill properly both by the creditor and by a duly appointed agent.

Written Exercise

163. Find the amount of the following bills:

1. MRS. S. H. POORE,

CHICAGO, July 20, 1908.

Bought of H. B. WILSON,

Dealer in GROCERIES, PROVISIONS, and SMALL WARES.

July	10	1 doz. Eggs	@ $.20 doz.	
		1 pint Cream	@ .60 qt.	
		1 loaf Bread	@ .05 loaf	
		6 bars Soap	@ .04 bar	
"	18	1 pkg. Ivorine	@ .10 pkg.	
		1 bottle Ammonia	@ .10 bottle	
"	19	1 lb. Butter	@ .30 lb.	
		1 qt. Milk	@ .06 qt.	

August 16, 1908.

2. MRS. S. H. POORE,

Bought of H. B. WILSON,

Dealer in GROCERIES, SMALL WARES, and PROVISIONS.

Aug.	6	1 gal. Oil	@ $.15	
		1 pkg. Pettijohn	@ .15	
		1 Yeast Cake	@ .02	
"	10	4 lb. Lamb	@ .16	
		1 pkg. Shredded Wheat	@ .12	
		5 lb. Beef	@ .22	

BOSTON, June 15, 19—.

3. MR. REED APPLETON,

Bought of JONES, MCDUFFEE & STRATTON.

June	10	⅔ doz. plates	@ $15.60	
"	10	⅔ doz. soup plates	@ 14.40	

Written Exercise

164. Make out bills for the following sales, supplying dates, when wanting:

1. John Carter bought of Frank Smiley, Jan. 4, 1907, 1 horse for $195, 2 cows at $50 apiece, 1 wagon for $62, 2 shovels at $1.12 apiece, 30 bushels of corn at 65¢ per bushel, and 17 bushels of wheat at $1.62 per bushel.

2. Styles Frost sold to Frederick Long 2 pieces flannel of 62 yards each at 49¢ per yard; 38 yards ticking at 29¢; 80 yards brown sheeting at 25¢; and 42 yards cassimere at $3.65.

3. Riggs & Sears bought of Agnos & Allen, 24 sack coats at $15.75; 36 vests at $3.50; 9 dozen felt hats at $36 per dozen; 4 dozen pairs suspenders at 37½¢ per pair; and 23 dozen pairs gloves at 66⅔¢ per pair.

4. Sell to your neighbor John White 4 pear trees at $1.75 each, 9 plants at 7¢ each, 12 geraniums at 33⅓¢ each, and make out the bill.

5. Sell three different articles from a dry-goods store, and make out and receipt the bill.

6. Miss Mary Ames bought of R. H. Stearns & Co., 16 yards of gingham at 37½¢ a yard, 14 yards of muslin at 25¢ a yard, 18 yards of silk at $1.25 a yard, and a pair of kid gloves for $1.50.

7. Mr. George Perkins sold to Mrs. Alfred Nelson 40 lb. of sugar at 5¢ a pound, 2 lb. of coffee at 35¢ a pound, 5 lb. of crackers at 10¢ a pound, and 5 lb. of rice at 9¢ a pound.

8. Mr. James Haynes bought of Henry Merrill 16 rolls of wall paper at 12½¢ a roll, 48 yd. of border at 8⅓¢ a yard, 64 feet of molding at 6¼¢ a foot.

9. Why should a bill be dated? When should it be receipted? Is it a good plan to keep receipted bills? Why?

165. Measures of Length or Distance

TABLE

12 inches (in. or ″)	= 1 foot (ft. or ′).
3 feet	= 1 yard (yd.).
5½ yards or 16½ ft.	= 1 rod (rd.).
320 rods	= 1 statute mile (mi.).
1 mile = 320 rd.	= 1760 yd. = 5280 ft.

A nautical mile, called a knot, is about 1.15 miles. A fathom is 6 feet.

166. Measures of Surface

TABLE

144 square inches (sq. in.)	= 1 square foot (sq. ft.).
9 square feet	= 1 square yard (sq. yd.).
30¼ square yards or 272¼ sq. ft.	= 1 square rod (sq. rd.).
160 square rods	= 1 acre (A.).
640 acres	= 1 square mile (sq. mi.).

A square of flooring, of shingles, slating, or roofing of any kind contains 100 square feet.

167. Measures of Volume

TABLE

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.).
27 cubic feet	= 1 cubic yard (cu. yd.).
128 cubic feet	= 1 cord (cd.).
16 cubic feet	= 1 cord foot (cd. ft.).
8 cord feet	= 1 cord.

Wood is measured by the cord. A cord is understood to be a pile 8 feet long, 4 feet wide, and 4 feet high. 1 cord foot is understood to be a pile 4 feet wide, 4 feet high, 1 foot long, *i.e.* $\frac{1}{8}$ as long as the cord.

168. Measures of Liquids

TABLE

4 gills (gi.)	= 1 pint (pt.).
2 pints	= 1 quart (qt.).
4 quarts	= 1 gallon (gal.).
63 gallons	= 1 hogshead (hhd.).

The standard unit is the gallon; it contains 231 cubic inches.

The barrel, when used for measuring, is ½ hogshead or 31½ gallons.

169. Dry Measures

TABLE

2 pints (pt.)	= 1 quart (qt.).
8 quarts	= 1 peck (pk.).
4 pecks	= 1 bushel (bu.).

The standard unit is the bushel; it contains 2150.42 cubic inches.

The bushel contains about 1¼ cubic feet.

170. Measures of Avoirdupois Weight

TABLE

16 ounces (oz.)	= 1 pound (lb.).
100 pounds	= 1 hundredweight (cwt.).
2000 pounds	= 1 ton (T.).
2240 pounds	= 1 long ton (L. T.).

171. The following units also are used in business transactions:

1 barrel (bbl.) of flour	= 196 lb.	1 bushel of coarse salt	= 56 lb.
1 barrel of pork or beef	= 200 lb.	1 cental of grain	= 100 lb.
1 quintal of fish	= 100 lb.	1 firkin of butter	= 56 lb.

172. Measures of Value

UNITED STATES MONEY

TABLE

10 mills (m.) = 1 cent (ct. or ¢).
10 cents = 1 dime (d.).
10 dimes = 1 dollar ($).
10 dollars = 1 eagle (E.).

The standard unit of value in the United States is the dollar.

173. Measures of Counting and Paper

TABLE OF COUNTING	TABLE OF PAPER
12 things = 1 dozen (doz.).	24 sheets = 1 quire.
12 dozen = 1 gross.	20 quires = 1 ream.
12 gross = 1 great gross.	2 reams = 1 bundle.
20 things = 1 score.	5 bundles = 1 bale.

174. Measures of Time

60 seconds (sec.) = 1 minute (min.).
60 minutes = 1 hour (hr.).
24 hours = 1 day (da.).
7 days = 1 week (wk.).
52 weeks 1 day, or 365 days = 1 common year.
366 days = 1 leap year.
100 years = 1 century.

The standard units of time measure are the day and the year.

175. Measures of Angles and Circles

60 seconds (″) = 1 minute (′).
60 minutes = 1 degree (°).
360 degrees = 1 circumference (circ.).

176. The year is divided into 12 calendar months as follows:

January (Jan.) of 31 da.	July of 31 da.
February (Feb.) of 28 or 29 da.	August (Aug.) of 31 da.
March (Mar.) of 31 da.	September (Sept.) of 30 da.
April (Apr.) of 30 da.	October (Oct.) of 31 da.
May of 31 da.	November (Nov.) of 30 da.
June of 30 da.	December (Dec.) of 31 da.

177. A day is about the time it takes the earth to rotate on its axis.

178. A solar year is the time it takes the earth to revolve around the sun, which is nearly $365\frac{1}{4}$ days.

179. One extra day is given to leap year to make up for the $\frac{1}{4}$ day dropped from the solar year. This day is added to February in centennial years that are divisible by 400 and in all other years divisible by 4.

180. In most business transactions 30 days are counted a month.

COMPOUND DENOMINATE NUMBERS

181. Illustrative Example. In a line 30 inches long there are how many feet?

SOLUTION. 12 inches = 1 foot; 30 inches equal as many feet as there are 12's in 30; there are two 12's in 30 and 6 inches remain; then, in 30 inches there are 2 feet and 6 inches.

In the number "2 feet 6 inches" the units are named.

182. A number whose units are named is called a **denominate number.**

183. A number, as "2 feet 6 inches," consisting of two or more units of different names, is called a **compound denominate number.**

184. In the expression, "two 12's in 30," 2, 12, and 30, whose units are not named, are called **abstract numbers.**

Oral Exercise

185. There are how many:

1. Gills in 6 quarts?
2. Pints in 8 gallons?
3. Gallons in 32 pints?
4. Days in 4 weeks?
5. Pounds in 48 ounces?
6. Ounces in 5 pounds?
7. Pints in 6 quarts 1 pint?
8. Weeks in 75 days?
9. Hours in $\frac{3}{4}$ day?
10. Inches in 10 feet?
11. Inches in 1 yard?
12. Yards in 4 rods?
13. Gills in 4 quarts?
14. Pints in 4 gallons 1 pint?

In the above examples denominate numbers are changed from one denomination to another. The process is called **reduction.**

186. Illustrative Example. Reduce 6 gal. 3 qt. 1 pt. to pints.

WORK

6 gal. 3 qt. 1 pt.
4
27
2
55

EXPLANATION. Since 1 gal. = 4 qt., 6 gal. = 6 times 4 qt.; adding the 3 qt., we have 27 qt. Since 1 qt. = 2 pt., 27 qt. = 27 times 2 pt.; adding the 1 pt., we have 55 pt. *Ans.* 55 pints.

In the above example the denominate numbers 6 gal. 3 qt. are changed to numbers of a lower denomination. The process is called **reduction descending.**

To change a number to units of a lower denomination, we multiply the number of the highest denomination by the number which is required of the next lower denomination to make one of the higher and to the product add the given number of the lower denomination. We multiply this sum in like manner, and so continue till the required denomination is reached.

Written Exercise

187. Find the number of:

1. Quarts in 4 bu. 3 pk. 5 qt.
2. Gills in 5 gal. 3 qt. 1 pt.
3. Inches in 3 yd. 1 ft. 4 in.
4. Ounces in 10 lb. 12 oz. Avoir.
5. Seconds in 2 wk. 6 da. 8 hr.
6. Square feet in 18 sq. yd.
7. Square inches in 46 sq. yd.
8. Cubic inches in 60 cu. ft.
9. In. in 56 ft. 9 in.
10. Ft. in 2 mi. 3 rd.
11. Rd. in 93 mi.
12. Yd. in 80 rd. 3 yd.
13. Cu. ft. in 8 cd. 60 cu. ft.
14. Min. in 7 hr. 40 min.
15. Lb. in 4 T. 650 lb.
16. Ft. in 90 rd. 5 yd.

17. Find the value of 3 lb. 4 oz. gold at $20 an oz.

18. What is the value of 12 bushels of apples at 65¢ a peck and $14\frac{1}{2}$ bushels of walnuts at 12¢ a quart?

19. When the price of milk is 8¢ a quart and of cream 30¢ a pint, what is the cost of 15 gal. 2 qt. of milk and 3 qt. 1 pt. of cream?

20. 28 rods 6 feet of road was fenced on both sides at 37¢ a foot. Find the cost.

21. What is the value of a house lot 100 feet square at 40¢ a square foot?

22. At 20¢ a square foot, what is the cost of 120 square rods of land?

23. Between June 15 and August 29 there are how many days? hours?

24. At 60¢ an hour, what are the wages of a person working 8 hours a day for the working days of 2 weeks?

Oral Exercise

188. Illustrative Example. Change $\frac{2}{3}$ of a rod to yards and feet.

WORK

$\frac{2}{3}$ rd. $= \frac{2}{3}$ of $5\frac{1}{2}$ yd. $= \frac{2}{3}$ of $\frac{11}{2}$ yd. $= 3\frac{2}{3}$ yd.

$\frac{2}{3}$ yd. $= \frac{2}{3}$ of 3 ft. $= 2$ ft. *Ans.* 2 yd. 2 ft.

To change a given fraction of one denomination to whole numbers of a lower denomination, we multiply the given fraction by the number it takes of the next lower denomination to make one of the given denomination. If a fraction occurs in the result, we proceed with it as with the first fraction, and so continue as far as required.

Change:

1. $\frac{3}{4}$ yd. to ft. and in.
2. $\frac{7}{8}$ bu. to pk. and qt.
3. $\frac{5}{8}$ lb. to oz.; $\frac{3}{8}$ lb. to oz.
4. $\frac{2}{3}$ rd. to yd. and ft.
5. $\frac{3}{5}$ gal. to qt. and pt.
6. $\frac{1}{2}$ yd. to ft. and in.

Written Exercise

189. Change to units of lower denominations:

1. $\frac{5}{9}$ hr.
2. $\frac{5}{9}$ da.
3. $\frac{3}{8}$ cwt.
4. $\frac{7}{8}$ T.
5. $\frac{7}{12}$ hhd.
6. $\frac{7}{18}$ cu. yd.
7. $\frac{4}{5}$ A.
8. $\frac{7}{11}$ mi.
9. $\frac{3}{4}$ rd.
10. $\frac{3}{4}$ of 30 da.
11. $\frac{4}{9}$ sq. rd.
12. .66 rod

Work of example 12: .66 rd. $=$ .66 of $5\frac{1}{2}$ yd. $=$ 3.63 yd. .63 yd. $=$ .63 of 3 ft. $=$ 1.89 ft. *Ans.* 3 yd. 1.89 ft.

13. Change 2.25 mi. to ft.
14. Change 12.5 A. to sq. rd.
15. 8.09 cu. ft. to cu. in.
16. 6.25 sq. mi. to A.
17. At 20 ¢ a square foot, what is the cost of .75 acre of land?

Oral Exercise

190. There are how many:

1. Yards in 24 ft.?
2. Weeks in 56 da.?
3. Gallons in 17 qt.?
4. Pounds in 20 oz.?
5. Square yards in 288 sq. in.?
6. Square yards in 36 sq. ft.?

In the above examples each denominate number is to be reduced (changed) to units of higher denominations. The process is called **reduction ascending.**

191. Illustrative Example. Change 222 gills to pints, quarts, and gallons.

WORK

4)222—2 gi.
2) 55—1 pt.
4) 27—3 qt.
6 gal.

EXPLANATION. Dividing 222 gills by 4, we get 55 for the number of pints with 2 gills over. Dividing 55 pints by 2, we get 27 for the number of quarts with 1 pint over. Dividing 27 quarts by 4, we get 6 for the number of gallons with 3 quarts over. *Ans.* 6 gal. 3 qt. 1 pt. 2 gi.

To change a given number to units of higher denominations, we divide the given number by the number it takes of its denomination to make one of the next higher. We divide the quotient in the same way and so proceed till the required denomination is reached. The last quotient with the remainders, if there are any, will be the result required.

Written Exercise

192. Change to units of higher denominations:

1. 321 pecks
2. 562 pints
3. 428 ounces
4. 8642 minutes
5. 38,741 seconds
6. 2320 feet
7. 5841 square feet
8. 31,728 cubic inches
9. 857 quarts

Written Exercise

193. Illustrative Example. Change 424 ft. to units of higher denominations.

WORK

$3)\overline{424}$—1 ft.

$5\frac{1}{2})\overline{141}$—$3\frac{1}{2}$ yd.

$2 \quad 2$

$11)\overline{282}$

$\overline{25}$ rd.

EXPLANATION. Dividing 424 ft. by 3, we get 141 for the number of yards with 1 ft. over. Dividing 141 yd. by $5\frac{1}{2}$, we get 25 for the number of rods with 7 half yards over. 7 half yards, or $3\frac{1}{2}$ yd. = 3 yd. 1 ft. 6 in.

Ans. 25 rd. $3\frac{1}{2}$ yd. 1 ft., or 25 rd. 3 yd. 2 ft. 6 in.

Change to units of higher denominations:

1. 204 yards
2. 5320 feet
3. 604 feet
4. 189 inches
5. 3418 inches
6. 295 square feet
7. 2174 square inches
8. 1720 rods.
9. 520 square rods
10. 214 cubic yards
11. 203 cord feet
12. 10,315 cubic feet

13. The shadow cast by a tree being 320 feet long, what is the length of the shadow in rods?

14. If a tree contains 32,000 cubic feet of merchantable wood, how many cords will it make?

15. If the branches of a tree cover 5454 square feet of ground, how many square rods do they cover?

16. How many acres are there in a pasture containing 1448 square rods?

17. If the above pasture is cut up into lots which sell at 10 cents per square foot, for how much will the land sell?

18. A boy living on St. Nicholas Ave., by measuring found its width to be 546 inches. What is its width in yards, feet, and inches?

194. Illustrative Example. Change 3 qt. 1 pt. 3 gi. to the fraction of a gallon.

EXPLANATION. 3 qt. 1 pt. 3 gi. = 31 gi.; 1 gal. = 32 gi.
Therefore 31 gills is $\frac{31}{32}$ of a gallon. *Ans.* $\frac{31}{32}$ gal.

To change a compound number to a fraction of a higher denomination, we change the given compound number to its lowest denomination, and make it the numerator of a fraction. We change also to the same denomination one of the denomination with which the compound number is to be compared, and make it the denominator of the fraction.

Written Exercise

195. What part:

1. Of 1 bu. is 1 pk. 2 qt.?
2. Of 1 yd. is 2 ft. 6 in.?
3. Of 1 rd. is 4 yd. 2 ft.?
4. Of 1 gal. is 3 qt. 1 pt. 3 gi.?
5. Of 1 sq. yd. is 36 sq. in.?
6. Of 1 hhd. is 3 qt. 2 pt.?
7. Of 1 cwt. is 25 lb. 8 oz.?
8. Of 1 T. is 1 cwt. 50 lb.?
9. Of \$1 is 1 d. 1¢ 1 m.?
10. Of 1 da. is 5 hr. 40 min.?
11. What part of one week are 5 days 10 hours?
12. What part of 1 hundred dollars is 1 eagle and \$4?
13. What part of a long ton is 1 T. 500 lb. of coal?
14. At \$12 a ton, what is the cost of 6 T. 1500 lb. of hay?
15. At 70¢ a bushel, how much must be paid for 5 bu. 28 lb. of salt?
16. At \$60 an acre, find the cost of 2 A. 120 sq. rd. of land.
17. At \$3.50 a ream, what is the cost of 2 reams 5 quires of paper?
18. How much must I pay for 750 bricks at \$9 per thousand?
19. In some business transactions 360 days are considered a year. What part of a common year are 360 days?

Written Problems

196. 1. Find the value of 2 lb. 8 oz. gold at $21 an ounce.

2. If a gill of ice cream will serve 1 person, how many persons will 6 gallons 3 quarts 2 pints serve?

3. A man walks from his house to his office and back 4 times a day. The distance one way is 40 rods 6 yards. How many feet does he walk each day? How much more than 1 mile?

4. How many feet of fencing will be required to inclose a field 14 rods 9 feet long, and 11 rods 6 feet wide?

5. I bought two 6-gallon cans of sirup. How many pints had I? If I paid $6 a can, how much did 1 pint cost?

6. For $\frac{2}{5}$ of a bushel of potatoes 60¢ was paid. What was the cost per peck?

7. How much remains of a journey of 54 miles after 7 miles $85\frac{1}{2}$ rods have been traveled?

8. How much wood is there in 20 loads, each containing 1 cord 3 cord feet?

9. What is the cost of 16 loads of coal, averaging 1 ton 960 pounds at $6.75 a ton?

10. Find the contents of 324 jars, each containing 1 pint 3 gills of preserve.

11. A car of 450 baskets of peaches, each 1 peck 3 quarts, contains how many bushels?

12. If I put 3 hogsheads of mineral water into jugs, each holding 1 gallon 3 quarts 1 pint, how many jugs do I require?

13. How much would be gained by buying 500,000 feet of lumber at $11.40 a thousand feet and selling at $2\frac{3}{4}$ cents per foot?

Written Exercise

197. 1. Allowing for each shoe 14 ounces of iron, how many horseshoes can be made from $\frac{1}{2}$ cwt. of iron?

2. How much earth is removed in 120 loads each containing 1 cubic yard $20\frac{1}{2}$ cubic feet?

3. If a horse is fed 12 quarts of oats a day, how many days will 6 bushels 2 pecks last?

4. How many barrels, each holding 2 bushels 3 pecks, will contain 121 bushels of oysters?

5. Find the cost of 4 A. 32 sq. rd. of land at $600 an acre.

6. When an express train goes 72.8 miles in 1 hour, what is the average time per mile?

Find the distance run per hour by the passenger trains on the following railroads on a certain day:

	Railroad	Terminals	Distance Miles	Time H.	Time M.
7.	West Shore	E. Buffalo — Frankfort	201.7	4	00
8.	N. Y. Central	Albany — Syracuse	48	2	10
9.	Burlington Route	Eckley — Ray	14.8		9
10.	Lake Shore	Kendallville — Toledo	91	1	15
11.	Great Western (Eng.)	Radington — Bristol	118.5	1	24
12.	Pennsylvania	Chicago — Pittsburg	468	7	20
13.	L. Shore & Mich. S'th'n	Buffalo — Chicago	525	7	50
14.	Pennsylvania	Wash'ton, O. — Ft. Wayne	81	1	04

15. The sidewalk on Lexington Ave. is 18 ft. 6 in. wide. How many square yards of concrete will be required to cover 90 ft. of the length of this walk? How many bricks 8 in. by 4 in. will be required to cover 80 feet in length of this walk?

16. A sidewalk contains 1100 squares of concrete, each square 4 feet on a side. The walk is in front of 40 house lots, each 4 rods wide on the walk. Find the width of the walk.

198. BOSTON, Rutherford Ave., 7/6, 1908.

H. M. MORTON,
Boston, Mass.

Pro. No. 3655.

Car Initial B. M. Number 41928

To BOSTON & MAINE RAILROAD, Dr.
For Transportation and Charges
From Lynn, Mass., 7/6, 1908.

Way Bill No. 18.

ARTICLES	WEIGHT	RATE	FREIGHT	ADVANCES	TOTAL TO COLLECT
1 Head Board 1 Foot Board 2 Iron Rails 1 Bdl. Bedding	210	16¢	34¢	50¢	84¢

Original Car.

Make Checks Payable to
BOSTON & MAINE RAILROAD.

SAXTON,
Freight Cashier.

Written Exercise

199. The above is a copy of a freight bill.

At the same rate, 16¢ per 100 lb., calculate:

1. The freight on a lot of furniture weighing 1650 lb.
2. The freight on a lot of hardware weighing 960 lb.

MR. C. W. AYER, PORTLAND, MAINE, 7/5, 1908.

To RUSSELL & CO.'s EXPRESS, Dr.

For Transportation of the following articles from Dover, N. H.

21 Boxes, 240 lb. weight, at 75¢ per hundred $1.80

Received Payment for Russell & Co.
P. Q.

Find the express at the rates given above and make bills in due form for the following:

3. On a box of books, weight 380 lb., from Springfield to Boston, at 95¢ a hundred.

4. On a lot of groceries, weight 430 lb., at 50¢ a hundred, from Worcester to Boston.

200. WESTERN UNION TELEGRAPH COMPANY.

ROBERT C. LOWRY, President & Gen'l Manager.

Receiver's No. ——.	Time Filed ——.	Check ——.

Send the following message subject to the terms on back hereof, which are hereby agreed to:

To Mr. James H. Foster, Plankinton Hotel, Milwaukee, Wis.

Wire instructions for disposal cargo arrived Thursday, noon. Letter following explains.

PORTER C. KING.

Written Exercise

201. 1. At the rate of 25¢ for 10 words and 2¢ additional for each word in excess of 10, what is the cost of sending the above telegram? No charge is made for date or signature.

2. Make up other telegrams and determine the cost of sending each. See that no unnecessary words are used, thus avoiding expense.

For payment in the United States, Hawaii, Porto Rico, the Philippines, Canada, and Cuba, the following rates are charged for money orders by the United States Post-office Department:

For orders for sums,

To $2.50, 3¢	From $30.00 to 40.00, 15¢
From $2.50 to $5.00, 5¢	From $40.00 to $50.00, 18¢
From $5.00 to $10.00, 8¢	From $50.00 to $60.00, 20¢
From $10.00 to $20.00, 10¢	From $60.00 to $75.00, 25¢
From $20.00 to $30.00, 12¢	From $75.00 to $100.00, 30¢

202. *The largest amount for which a single money order may be issued is $100. For a larger sum additional orders must be sent.*

The rates for express money orders are practically the same.

Oral and Written Exercise

203. 1. How much will a money order fee be for an amount sufficient to pay for 3 subscriptions to the *Youth's Companion* at $1.75 each?

2. How much is the fee for a money order to the Enterprise Supply Company for $10 worth of groceries?

3. How much is the fee for a money order for $50? for $68? for $2.50? for $24.63?

4. The following transactions took place between a Chicago business firm and an Eastern customer. The customer returned to the firm 6 yards of dress goods, which had been bought of the firm and paid for at 42¢ a yard, and at the same time ordered 9 yards at 69¢ a yard and 9 yards at 50¢ a yard, inclosing a money order of $9 for the goods. If the firm is allowed 70¢ for express charges, how much must they pay for a money order to balance the account?

NOTE. If blanks for application and for forms of money orders are obtainable, the teacher should show these to the pupils and explain their use.

5. What fee must be paid for a money order from New York on Manila, Philippine Islands, for the amount of $65?

6. Mr. Stanley sends a money order from Newcastle, Pennsylvania, to Bridgeport, Connecticut, for the amount of $16.30. He tenders the postal clerk two ten-dollar bills in payment for the order and the fee. What amount of change does he receive?

7. A book agent sells 94 books at $1.50 each. He deducts 40¢ for each dollar's worth that he sells, and sends the publishers a money order for the balance. What is the amount of the order and the fee for sending it?

Written Exercise

204. Add:

1.	2.	3.	4.
625.04	82.45	1.23	.01
434.1	58.9	15.051	.001
69.3	6.23	9.237	.011
883.7	801.15	64.84	.111
97.8	3.27	2.78	.01
208.4	.07	81.59	.0111
42.5	.05	10.265	.01

5.	6.	7.	8.
802.4	.783	1.304	.29091
.693	.0624	.724	.08062
.852	.935	6.109	.03076
2.74	.4602	.5	.507
2.493	9.807	3.907	.298
.904	10.9205	6.372	.0079
9.206	.7206	4.108	.00430

Subtract:

9.	10.	11.	12.
23.09	8.902	3.726	89.04
6.84	4.92	.992	6.89

13.	14.	15.	16.
1.053	.2908	82.184	64.035
.876	.1985	2.909	37.029

17.	18.	19.	20.
68.431	201.98	62.305	.001
28.209	72.89	51.978	.00011

21. 4.1×6.64	**24.** 1.5×553.53	**27.** $825.468 \div 4.2$
22. 6.3×1972.08	**25.** $.57 \times 49.007$	**28.** $1131.264 \div 4.8$
23. $301.60 \times .56$	**26.** $470.52 \div .65$	**29.** $87.3 \div 3.9$

Written Exercise

205. Market Quotations for Aug. 6, 1906.	From these quotations find the cost:
Flour, \$4.35 a bbl.	**1.** Of 5.5 bbl. of flour.
Hay, \$20 a T.	**2.** Of 8.25 T. of hay.
Ham, $14\frac{1}{8}$¢ a lb.	**3.** Of 12.75 lb. of ham.
Lamb, 15¢ a lb.	**4.** Of 10.04 lb. of lamb.
Butter, 22¢ a lb.	**5.** Of 2.20 lb. of butter.
Eggs, 25¢ a doz.	**6.** Of $15.33\frac{1}{3}$ doz. eggs.
Cheese, $11\frac{1}{2}$¢ a lb.	**7.** Of $18.87\frac{1}{2}$ lb. cheese.
Citron, 50¢ a lb.	**8.** Of $2.12\frac{1}{2}$ lb. citron.

9. Write in figures and add: 208 ten-thousandths; 1 and 45 thousandths; 18 ten-thousandths; 648 millionths; 6 thousand 48 millionths; 8 and 4003 ten-millionths.

10. From 6 hundred and 34 thousandths subtract 634 thousandths.

11. From 9 thousand and 486 thousandths subtract 9486 ten-thousandths.

12. In 8 months an engineer burned coal as follows: 18.03 T., 8.103 T., 10.57 T., 11.2 T., 13.023 T., 17 T. How much did he burn in all?

13. I bought a house for \$4875, and sold it for .78 of its cost. For how much did I sell it? How much did I lose?

14. If goods sold at 1.25 of their cost brought \$28.40, what was their cost?

15. If goods sold at .80 of their cost brought \$22.72, what was their cost?

Written Exercise

206. 1. A man has 321.9 lb. of paint. How much has a man who has 3.4 as much?

2. A farm contained 307.07 acres of land. 40.506 acres were sold. How many acres remained?

3. How much must I pay for 4.8 yd. of velvet, if 6.5 yd. cost $80.27\frac{1}{2}$?

4. A man paid $4234.375 for 67.75 acres of land. What was the price per acre?

5. A man having 99.438 A. of land sold 3.75 A., 8.05 A., and 12 A. How much had he left?

6. Divide 6.250 by 1.25; 19.60 by 140.

7. Multiply 76.81 by 3.2 and take .792 from the product.

8. Take twenty and ten thousandths from ninety and one hundred eleven hundred-thousandths.

9. Multiply six tenths by nineteen hundredths; five thousand by twenty thousandths; one hundred twenty-one thousandths by twelve and one tenth, and find the sum of the products.

10. Add nine and seven tenths, forty-one and eight hundredths; seventy-five and fifty-four hundredths; one hundred twenty-eight and one hundred eighty-seven thousandths.

11. Find the sum of 356 thousandths and 3 hundred and 56 ten-thousandths. Find the difference of these numbers.

12. Find the cost of 1487 packages of white practice paper at 16.5¢ per package and 745 packages of white composition paper at 33.7¢ per package.

Written Exercise

207. 1. At the rate of a mile in 3.5 min., how far will an automobile go in .25 of an hour?

2. At $45.75 an acre, what is a farm worth that is 125.7 rods long and 97.08 rods wide?

3. What is the perimeter, that is, the distance around the farm, in example 2? What is the cost of a fence to inclose the land at 19.8¢ a foot?

4. Find the cost of 712.75 lb. of tea at $87\frac{1}{2}$¢ per lb.

5. Find the product of 41.121 by .045.

6. How many miles an hour must a person travel to go 153 miles in 3 days, traveling 8.5 hours a day?

7. If a road rises 4.3 feet in every 50 feet, how much does it rise in a mile?

8. A wagon wheel is 3.5 feet across and 3.1416 times as far around. What is the distance around the wheel? How many times does it turn in going a mile?

9. A farm was divided by its owner into lots containing the following number of acres: 42.12, $17.12\frac{1}{2}$, $32.37\frac{1}{2}$, 56.012, 18.002. What was the total area?

10. What was the value of the above farm at $125 an acre?

11. A steer weighing 17.19 cwt. sold at the rate of $7.97¢ per cwt. What price did it sell for?

12. What distance can a horse travel in 19.6 minutes, going at the rate of 1 mile in 2.8 minutes?

13. At $0.75 for each cut, what does it cost to saw two cords of wood 4 feet long into pieces each 1 foot long? into pieces each .5 of a foot long?

Oral or Written Exercise

208. **1.** Express as decimal fractions:

$\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{1}{10}$, $\frac{3}{10}$, $\frac{1}{20}$, $\frac{3}{20}$, $\frac{1}{25}$, $\frac{3}{25}$.

2. Express as common fractions:

.5, .50, .2, .20, .6, .60, .8, .800, .25, .75.

Express as hundredths and memorize:

	a	*b*	*c*	*d*	*e*
3.	1	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{1}{8}$	$\frac{1}{12}$
4.	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{4}{5}$	$\frac{3}{8}$	$\frac{3}{12}$
5.	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{5}{8}$	$\frac{1}{16}$
6.	$\frac{2}{3}$	$\frac{2}{5}$	$\frac{5}{6}$	$\frac{1}{8}$	$\frac{3}{16}$

209. **Illustrative Examples.** (1) Find .16$\frac{2}{3}$ of 18. (2) Find .66$\frac{2}{3}$ of 60.

SOLUTION. (1) .16$\frac{2}{3}$ = $\frac{1}{6}$; $\frac{1}{6}$ of 18 = 3. *Ans.* 3.
(2) .66$\frac{2}{3}$ = $\frac{2}{3}$; $\frac{2}{3}$ of 60 = 40. *Ans.* 40.

Find:

7.	.2 of 40	**13.**	.6 of 75	**19.**	.06$\frac{1}{4}$ of 32
8.	.33$\frac{1}{3}$ of 33	**14.**	.16$\frac{2}{3}$ of 48	**20.**	.25 of 16
9.	.66$\frac{2}{3}$ of 36	**15.**	.83$\frac{1}{3}$ of 30	**21.**	.75 of 24
10.	.5 of 80	**16.**	.62$\frac{1}{2}$ of 56	**22.**	.4 of 20
11.	.50 of 80	**17.**	.37$\frac{1}{2}$ of 32	**23.**	.87$\frac{1}{2}$ of 64
12.	.08$\frac{1}{3}$ of 24	**18.**	.12$\frac{1}{2}$ of 96	**24.**	.8 of 50

25. On goods worth $40 a loss of .25 was made in selling. What was the selling price?

26. On a lot of furniture $5 a month is charged for storage. But $\frac{1}{6}$ less is charged for storage by the year. What is the cost for storage by the year?

Written Exercise

210. 1. The District of Columbia has an area of 70 sq. mi. and a population of 3,981.685 people per square mile. What is the total population?

2. The Erie Canal is 387 mi. long and rises a height of 572 ft. from Troy to Buffalo. How much does it rise per mile?

3. What is the total cost of a limited passenger train, if the engine costs $13,000, 5 Pullman coaches cost $12,000 each, 1 baggage car $4000, and 1 mail car $5000?

4. A freight car costs $600 and lasts 10 years. What is the cost per year?

5. An Ohio farmer owns a farm of 150 acres worth $125 per acre, farm buildings worth $3500, 6 horses worth $100 each, 130 sheep worth $3 each, 2 head of cattle worth $50 each, 14 hogs worth $11 each, 160 fowls worth 50¢ each, farming tools worth $1000, and standing crops worth $3000. What is the total value?

6. The Mississippi River falls 1600 feet in its course of 2500 miles. What is the fall per mile? Express it decimally.

7. The distance from New York to San Francisco *via* the Panama Canal is as follows:

From New York to Colon (by shortest route) . .	1980 miles
From Colon to Panama, about	50 miles
From Panama to San Francisco (direct)	3423 miles

What is the total distance *via* Canal?

8. The distance from New York to San Francisco *via* Cape Horn is 14,840 miles. How much distance is saved by the Canal route?

9. How many miles are there in the trip from New York to San Francisco *via* the Panama Canal and return *via* Cape Horn according to the figures given in examples 7 and 8?

Written Exercise

211. **1.** If there is a decrease of temperature of 1° F. for every 300 feet of ascent, how much difference in altitude might there be between two places that differ in temperature by 8° F.?

2. It costs 21¢ to carry a bushel of wheat from Fargo, North Dakota, to Liverpool, England. What would be the freight paid on a cargo of 30,000 bushels?

3. A large ocean steamship consumes an average of 457.85 tons of coal per day. How much is consumed in a trans-Atlantic voyage of 6 days?

4. A large freight steamer is designed to carry a load of 30,000 tons. How many trains of 50 cars, each car holding 15 tons, are required to furnish her cargo?

5. The railway mileage of the world in 1906 was as follows:

America	285,957 miles
Europe	192,521 miles
Asia	50,593 miles
Australia	17,441 miles
Africa	16,538 miles

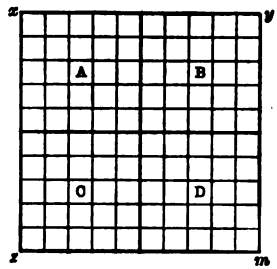
What was the total mileage?

6. If the freight rate on a bushel of wheat from Chicago to New York is $14\frac{1}{2}$¢, what would be the freight charged for a train of 50 cars, each car carrying 500 bushels of wheat?

7. A grain elevator at Buffalo will load 6 grain cars in 5 minutes. How many will it load at that rate in a working day of eight hours?

8. What is the freight on a car load of lumber from Chicago, Illinois, to Buffalo, New York, weight 3000 pounds, the rate 40¢ per hundred pounds?

Oral and Sight Exercise



212. **1.** Of the large square x, y, z, m, what part is A? What part is $A + B$? What part is $A + B + C$?

2. If the whole square is made up of 100 equal small squares, how many hundredths is A? $A + B$? $A + B + C$?

Then $\frac{1}{4}$ equals how many hundredths? $\frac{1}{2}$ equals how many hundredths? $\frac{3}{4}$ equals how many hundredths?

The words **per cent**, or this sign, %, may be used instead of the word hundredths. Thus, $\frac{25}{100} = 25$ per cent, or 25 %.

3. What per cent of a thing is $\frac{1}{100}$ of it? $\frac{5}{100}$ of it?

4. What per cent of a thing is $\frac{1}{4}$ of it? $\frac{1}{2}$ of it? $\frac{3}{4}$ of it?

5. What per cent of the square above is A? B? C? D? $A + B$? $A + B + C + D$?

6. What per cent of 1 is 1? What per cent of 1 is 2?

7. What per cent of 1 is $1\frac{1}{2}$? $1\frac{1}{4}$? $1\frac{3}{4}$?

8. Of 100 tulip bulbs planted 10 % did not come up. How many failed to come up? How many did come up? 10 % of a number is how many hundredths of it?

9. Of a quantity of corn all but 25 % is mildewed. What part of it is mildewed?

10. A piece of cloth is sold at a loss of 30 %. What per cent of its value is received for it?

11. To close out a lot of wall paper, a dealer sells it at a loss of 50 %. What per cent of its cost does he get for it?

12. How much does it sell for per roll if it cost 30 cents?

Written and Sight Exercise

213. Copy and express the following per cent rates as common fractions in their smallest terms:

Of any quantity:

	a	*b*	*c*	*d*
1.	50 % = $\frac{1}{2}$	12½ % =	40 % =	66⅔ % =
2.	25 % = $\frac{1}{4}$	8⅓ % =	75 % =	37½ % =
3.	20 % = $\frac{1}{5}$	10 % =	60 % =	62½ % =
4.	33⅓ % = $\frac{1}{3}$	30 % =	80 % =	87½ % =
5.	16⅔ % = $\frac{1}{6}$	70 % =	90 % =	6¼ % =

The above per cent rates are easier to use if expressed as common fractions. The pupil should know at sight the equivalent common fraction for each per cent rate.

Using the equivalent common fraction, find:

	e	*f*	*g*	*h*	*i*	*j*
6.	12½ % of 80	of 120	2400	$2.40	$.96	$1.20
7.	75 % of 8	of 16	24	48	200	$2000
8.	40 % of 20	of 25	30	35	40	$1.50
9.	33⅓ % of 6	of 18	24	30	36	$4.80
10.	16⅔ % of 66	of 120	180	$3	54¢	$4.20
11.	66⅔ % of 15	of 18	$1.50	90¢	$1.00	21 mo.
12.	60 % of 30	of 90	700	250	$600	$4000
13.	125 % of 64	of $960	6¾ wk.	$23.72	$.60	$25.60
14.	87½ % of 28	of 8¾ T.	86 A.	1 mile	96 qt.	$16.56

NOTE. Pupils should have many more similar exercises. They should make and dictate them to the class.

Oral Exercise

214. To find the percentage of a number.

1. In a hall there are 500 people, of whom 4 % are children. How many are children?

EXPLANATION. $4\% = \frac{4}{100}$; $\frac{1}{100}$ of 500 = 5; $\frac{4}{100}$ of 500 = 4 times 5, = 20.

2. A man raised 300 tons of hay and sold 8 % of it. How much did he sell?

3. What is 6 % of \$100? 12 % of \$2000?

4. A field yields 500 bushels of potatoes, and 11 % of them are unsalable. How many are unsalable?

Written Exercise

215. Illustrative Examples. (1) Find 8 % of \$923. (2) 25 % of \$600.

WORK

(1) \$923 × .08 = \$73.84

(2) $25\% = \frac{1}{4}$; $\frac{\$600 \times 1}{4} = \$150$

EXPLANATION. (1) 8 % = .08. .08 of \$923 = \$73.84 *Ans.*
(2) $25\% = \frac{1}{4}$; $\frac{1}{4}$ of \$600 = \$150 *Ans.*

To find the percentage of a given number, we multiply the given number by the rate per cent expressed either as a decimal or as a common fraction.

1. Find 15 % of 95 gal.
2. Find 25 % of 250 T.
3. Of 376 lb. find 7 %; $12\frac{1}{2}$ %.
4. Of \$6000 find $2\frac{1}{2}$ %; $16\frac{2}{3}$ %.
5. A dealer in grain bought 9420 bushels of corn, and the next day sold 25 % of it. How much did he sell?
6. Of a stock of 25,000 cattle, the owner lost 65 % during a cold winter. How many had he left?
7. How much can a man save a year if he earns \$1800, and spends in charity 10 % and on himself and family 75 %?

Written Exercise

216. **1.** A dealer sells \$150 worth of goods at a loss of 20%. What is the total loss and what is the selling price?

2. Find 25% of 3962 + 4% of \$1272.

3. If $62\frac{1}{2}\%$ of 480 bushels of corn were not salable, how many bushels were salable?

4. A farm costs \$2200. For how much must it be sold to gain 20%?

5. I had \$4804 and spent 3% of it. How much had I left?

6. A commission merchant sold 5% of 18,000 yd. of cotton cloth at 3¢ per yard. How much did he receive from the sale?

7. What is $\frac{3}{4}\%$ of \$400? $1\frac{1}{8}\%$ of \$633?

8. If you buy a house for \$8450, for how much must you sell it to gain 9%?

9. A speculator bought 760 bushels of apples. He sold $37\frac{1}{2}\%$ of them and lost by decay $37\frac{1}{2}\%$ more. How many had he left?

10. Of a mixed school numbering 380 children, 45% are boys. How many are girls?

11. Of 1408 sheep, a farmer sold $6\frac{1}{4}\%$. How many were sold?

12. Find $87\frac{1}{2}\%$ of \$14.40; $33\frac{1}{3}\%$ of \$14.40.

13. If you buy \$2.00 worth of fireworks at 15% discount, how much do they cost?

14. A \$32 suit is marked down 22%. What is the loss? What is the selling price?

217. To find a number of which a percentage is given.

Illustrative Examples. (1) $72 is 6% of what sum? (2) 20% of what sum?

WORK

(1) $\frac{\overset{12}{\cancel{72}} \times 100}{\cancel{6}} = 1200$

(2) $\frac{72 \times 5}{1} = 360$

SOLUTION. (1) 6% of anything $= \frac{6}{100}$ of it. Since $\frac{6}{100}$ of a sum is $72, $\frac{1}{100}$ of the sum $= \frac{1}{6}$ of $72, $= \$12$, and $\frac{100}{100}$, or the whole sum, is 100 times $\$12 = \$1200$. *Ans.* $1200.

(2) $20\% = \frac{1}{5}$. Since $\frac{1}{5}$ of the sum $= \$72$, $\frac{5}{5}$, or the whole sum, $= 5$ times $72 = \$360$. *Ans.* $360.

To find a number of which a percentage is given, we divide the given percentage by the rate per cent, and multiply by 100; *or, we change the per cent to a fraction in its smallest terms, and divide by the fraction.*

Oral Exercise

218. 1. 56 miles is 8% of what distance?

2. A family expends $30 a month for groceries, which is 20% of the monthly income. What is the monthly income?

3. A farmer has 50 A. of corn. This is 25% of his farm. How many acres are there in his farm?

4. If 96 pear trees equal 12% of the trees in an orchard, how many trees has the orchard?

5. A man borrowed a sum of money for a year. He paid $72 for it. If this was 6% of the sum borrowed, what was the sum?

6. An agent charges $45 for selling my house; this is 3% of what the house sells for. For how much does it sell?

7. If I pay for insuring my house $18.50 and this is $\frac{1}{2}$% on the sum insured, what is the sum insured?

8. If a man expends on various charities $125 and this is 10% of his income, what is his income?

Written Exercise

219. 1. If a man saves \$141.25 each year and this is $12\frac{1}{2}\%$ of his salary, what is his salary?

2. An estate was sold at a profit of 24%, which was \$480 above the cost. What was the cost?

3. I bought 2 houses and sold them at a gain of $8\frac{1}{3}\%$. How much did the two cost if my profit was \$300 on each house?

4. \$900 is 15% of what sum?

5. A dealer sold a lot of cotton at 30% profit and thereby gained \$558. What was the cost?

6. If \$43.50 is a profit of $33\frac{1}{3}\%$ on a sale, what is the amount of the sale? What is the cost of the goods?

7. Mr. Jewett sold 210 barrels of walnuts, which were 60% of all he had. How many had he?

8. A man pays \$70 on a bill, which is $16\frac{2}{3}\%$ of the bill. How much is the bill?

9. After investing a sum of money, Mr. Jones has \$4200 left, which is 30% of what he had at first. What sum did he have at first?

10. I paid \$900 for repairs upon a house. This was $16\frac{2}{3}\%$ of the first cost of the house. What was the first cost?

11. If 256 square rods is 80% of 2 acres, how many square rods are there in 2 acres?

12. A ranchman lost 20% of his cattle. If he had 1640 left, how many had he at first?

13. A man sold goods for \$13.50, which was 25% below cost. How much did they cost? What was the loss?

220. To find what per cent one number is of another.

Illustrative Examples. (1) What per cent of 20 is 7? (2) Of 20 is 5?

SOLUTION. (1) 7 is $\frac{7}{10}$ of 20, which equals $\frac{35}{100} = 35\%$. *Ans.* 35%.
(2) 5 is $\frac{5}{20}$, or $\frac{1}{4}$ of 20, which equals $\frac{25}{100} = 25\%$. *Ans.* 25%.

To find what per cent one number is of another, we express the relation as a common fraction in its lowest terms, and then change it to a decimal in hundredths.

Oral Exercise

221. What per cent:

1. Of 20 is 4? 3? 7? 10?
2. Of 25 is 5? 8? 10? 12?
3. Of 36 in. is 9 in.? 12 in.?
4. Of 1 gal. is 1 qt.? 1 pt.? 3 pt.?
5. Of 80 is 40? 80? 120?
6. Of 250 is 150? 250?
7. Of 1000 is 100? 125?
8. Of 5000 is 1000? 750?
9. Sugar costing 5¢ per lb. sells at 7¢. What % is gained?
10. Oranges bought at $4 a box sell at $3. What % is lost?
11. Losing 6 plants out of 48 is a loss of what per cent?

Written Exercise

222. Illustrative Example. What per cent of $75 is $47?

$\frac{47.00}{75} = .62\frac{2}{3}$. SOLUTION. 47 is $\frac{47}{75}$ of 75. 47 changed to hundredths $= 47.00$; $47.00 \div 75 = .62\frac{2}{3} = 62\frac{2}{3}\%$. *Ans.* $62\frac{2}{3}\%$.

1. What per cent is gained by selling an article for $3.75 that cost $2?
2. Of a school of 80 pupils 15 study geometry. What per cent study geometry?
3. What % is lost by buying beef at $15 a barrel and selling it at $12\frac{1}{2}$ a barrel?

Written Exercise

223. 1. 80 yards is 22 % of what number of yards?

2. \$120 is my commission on sales amounting to \$8000. What is the per cent of commission?

3. \$160 is what per cent of \$400?

4. \$24 is what per cent of \$320?

5. What per cent of 560 acres are 10 acres?

6. What per cent do I make if I gain \$600 on a sale of \$300 worth of goods?

7. I pay \$45 for insuring property for \$3000. What is the rate per cent of insurance?

8. If a house worth \$4000 rents for \$500, what per cent of the value of the house is the rent?

9. A merchant lost \$60 by selling a lot of cloth at $16\frac{2}{3}$ % below the cost. If there were 600 yards, how much did he pay for it per yard? How much did he sell it for per yard?

10. A wholesale merchant makes a discount of \$50 on a bill of \$900. What is the rate per cent of discount?

11. An agent sells goods to the amount of \$350 and keeps \$17.50 as his commission. What is the rate per cent of commission?

12. A man owes \$800. If he pays \$50 a month, what per cent does he pay each month? What per cent will remain to be paid at the end of one year?

13. Mr. Elder's household expenses for 1906 were \$960; for 1907 they were \$1100. What was the per cent of increase?

14. Mr. Elder's income for 1907 was \$1600. What per cent of his income were his household expenses?

Written Exercise

224. 1. A carriage that cost $350 was sold for 18% above cost. How much was the profit?

2. At what price must coffee that cost 17½¢ a pound be sold to make a profit of 20%?

3. Cloth that cost $1.20 a yard is sold at a profit of 35%. At what price is it sold?

4. A horse that cost $225 was sold for 25% less than cost. How much was the loss?

5. A dealer bought 200 pairs of shoes for $350. At what price a pair must he sell them to gain 20%?

6. What per cent of profit is made on butter bought at 23¢ and sold at 28¢ per pound?

7. A piano was bought for $500 and sold for $420. What per cent was lost?

8. By buying beef at $12 per barrel and selling it at $15.60, what per cent is gained?

9. What per cent is lost by buying beef at $15.60 and selling at $12 per barrel?

10. A piece of land was sold at an advance of 45% on the cost. If it was sold for $2610, how much did it cost?

11. A house sold for $3500 at a loss of 30% on the cost. How much did the house cost?

12. By selling 2 cows at $72 each, I gained 20% on one, and lost 20% on the other. How much did the cows cost? Which was the greater, my gain or loss?

13. By selling lumber at $27.60 per thousand, there is a profit of 15%. How much did the lumber cost?

14. By selling a lot of wheat at 15% profit, a dealer gained $83.70. How much did the wheat cost?

Written Exercise

225. 1. A broker sold 2 shares of stock at $60 each. On one he gained 5 %, on the other he lost 5 %. What was the total gain or loss?

2. A boy attended school 70 days. His attendance was marked 87½ %. How many days was he absent?

3. A house sold for $4500, which was 12½ % more than it cost. How much did it cost?

4. I sent to my agent in Portland $630. After deducting his commission of 5 % on a sum which was included, he spent the rest of the money for canned corn at 8⅓ ¢ a can. How many cans could he buy?

NOTE. The commission being 5 % of the sum to be spent, the $630 must be 105 % of the sum to be spent.

5. An agent's commission of 5 % for buying flour at $4.50 a barrel was $24.30. What number of barrels could be bought?

6. A clothier sold a suit of clothes for $27, which was 6¼ % discount from his marked price. Find the marked price. Find the discount.

7. 24 hours is what per cent of a week?

8. A skittish horse was sold for $140.50, which was ⅕ less than it cost. What was the per cent of loss? the total loss?

9. Mr. Andrews bought a lot of land for $900, and upon it he built a house costing $3500. He rented the place so that it yielded 5 % annually on the investment after allowing $110 for repairs, taxes, and insurance. How much was the rent?

10. What sum invested at 3½ % will yield an annual income of $2800?

Written Exercise

226. **1.** During the year ending June 30, 1906, the immigration into the United States aggregated 1,100,073. This was greater than that for the year ending June, 1905, by 73,574. What were the figures for the year ending June, 1905?

2. The daily government receipts for July 30, 1906, were as follows:

From International Revenue	$371,071
From Customs	959,695
From Miscellaneous	60,786

What were the total receipts?

3. The daily expenditures by the government for July 30, 1906, were $1,700,000. Which were the greater, the receipts or expenditures for July 30? How much?

4. There were in the United States Treasury on July 24, 1906, $99,255,972 in gold and $7,544,280 in silver. How much more gold was there than silver?

5. The total government receipts for the month ending July 24, 1906, were $39,572,142. The total expenditures were $51,410,000. How much more was spent than was received?

6. In the year 1904, when the population of the United States was 81,782,000, the total consumption of tobacco was 440,000,000 pounds. How much was this to a person?

7. In the year 1890 the population of the city of New York was 2,507,414; in 1900 it was approximately $37\frac{1}{10}\%$ greater. What was the population in 1900?

8. If the average receipts and expenditures per day during the month of July were equal to those for July 30, examples 2 and 3, what was their difference for the month?

Written Exercise

ALMANAC *July* 25

Sun rises	4:29
Sun sets	7:12
Length of day	14:43
Moon sets	9:44 P.M.
High Water	1:35 A.M. 2:02 P.M.
Height of Tide	10 ft. A.M.
	9 ft. 5 in. P.M.

July 29

Sun rises	4:33
Sun sets	7:08
Length of day	14:35
Moon sets	11:57 P.M.
High Water	5:03 A.M. 5:33 P.M.
Height of Tide	9 ft. A.M.
	9 ft. 7 in. P.M.

227. The figures in this almanac are for Boston and vicinity. From them answer the following questions:

1. How do you find the length of the day, 14 hr. 43 min., for July 25?

2. Find the difference between the time of sunrise and sunset, and see whether it agrees with the length of day given.

3. How much later did the sun rise on July 29 than on July 25?

4. What was the difference in the time of sunset July 25 and July 29?

5. See if the length of the day on July 25 agrees with that given in the almanac.

6. Which was the shorter day, July 25 or July 29? Were the days shortening or lengthening?

7. What was the difference in their length July 25 and 29?

8. What was the average daily loss for the 5 days?

9. What was the difference in the time the moon set?

10. What was the difference in the time between high water in the morning and afternoon July 29? July 25?

11. What was the difference in height of tides July 25?

Written Exercise

228. 1. The mines of California yield approximately 26,000 flasks of quicksilver yearly. Its value is $1,200,000. What is the value per flask?

2. At the rate of 320 bushels to a car and 30 car loads per day, how many bushels of oysters are shipped from Baltimore during a month of 30 days?

3. Australia bought from the United States, in 1900, goods valued at $28,164,000 and sold to the United States $5,263,000 worth. Find how much more was bought than sold.

4. Cuba has an area of 44,015 square miles. Porto Rico has 3435 square miles. How much larger is Cuba than Porto Rico?

5. Find the total area of the countries possessed by the United States:

Hawaii	6449 square miles.	Porto Rico	3435 square miles.
Guam	210 square miles.	Alaska	590,844 square miles.
Tutuila	77 square miles.	Philippines	115,026 square miles.

Panama Canal Zone 474 square miles.

6. The length of the earth's axis is about 7900 miles. What is the distance from the circumference to the center?

7. Cuba contains 44,015 square miles and has a population of 1,573,000. What is the population per square mile?

8. The estimated area of the world's coal fields in square miles is as follows:

China and Japan, 200,000; United States, 194,000; India, 35,000; Russia, 27,000; Great Britain, 9000; Germany, 3600; France, 1800; Spain and other countries, 1400. What is the total area?

Oral Exercise

229. 1. How many 15-minute periods are there in 1 hour? in 6 hours?

2. At the rate of 8 hours per day, how many hours does a man work in the working days of a week?

3. How many weeks old is a child who is 2 years old? How many months?

4. What is the number of hours from 12 o'clock noon to 5:30 the next morning?

5. From 1:30 P.M. to 6:30 P.M., the temperature fell from 75° to 65°. What was the average rate of falling per hour?

6. How many centuries are there in 500 years?

7. How many seconds are there in 2 minutes? in $1\frac{1}{2}$ minutes?

8. How many minutes are there in $\frac{1}{2}$ hour? in $1\frac{1}{2}$ hours? in $2\frac{1}{2}$ hours?

9. How many days are there in 8 weeks 6 days?

10. How many weeks and days are there in 60 days? in 55 days? in 34 days?

11. At the rate of a mile in 5 minutes, how many miles can be traveled in 1 hour?

12. How many minutes are there in .1 of an hour? in .2? in .5? in .25? in .75?

13. A man walked $22\frac{3}{4}$ miles in 7 hours. What was his rate per hour?

14. Of 1 hour find $16\frac{2}{3}\%$; 25%; 75%; 10%; 20%; 50%.

Written Exercise

230. 1. The circumference of the earth is 25,000 miles. At what rate per hour are you moving on the earth's surface if it takes 24 hours for the earth to make a complete rotation on its axis?

2. In 3 years 5 months 6 days there are how many days?

3. Change 6 years 3 months 6 days to hours.

4. In the months of April, June, and November, $16\frac{2}{3}$ % of the days were stormy. How many were pleasant?

5. How many days are there from June 16 to September 2?

6. Find the time in years, months, and days from July 4, 1776, to August 10, 1906.

7. Find the exact length of time from October 12, 1492, to April 19, 1775.

8. How many weeks and days are there in a common year? in 3 common years? in 3 leap years?

9. Multiply 1 day 2 hours 15 minutes by 6.

10. At the rate of $3\frac{1}{4}$ miles per hour, how far can a man walk in $23\frac{1}{5}$ hours?

11. If a man earns \$15.74 in 5.5 days, how much does he earn in 1 day?

12. How long will it take to travel 54 miles at the rate of $4\frac{1}{2}$ miles per hour?

13. How much will a man earn in 5 days 7 hours at the rate of \$15 per week of 6 days of 10 hours each?

14. Measure the floor surface and the lighting surface in your schoolroom, and find how many times as great the former is as the latter.

Written Exercise

231. Draw a plan of the lot in the next question to a scale of $\frac{1}{16}$ of an inch to a foot and make additions to it as you proceed with the other questions.

1. A schoolhouse was built on a lot 250 feet wide and 310 feet long. What was the cost of the lot at \$.20 a square foot?

2. The girls' playground was 55 feet by 80 feet, and the boys' playground was 40 feet by 75 feet. Who had the larger playground? How much larger?

3. What is the cost of fencing the schoolhouse lot at 45 ¢ a yard?

4. The girls had in their playground a bed of nasturtiums 5 feet long and $4\frac{1}{5}$ feet wide. How much space was taken up by the flower bed?

5. How many flower beds of the same size could the girls have made from their playground?

6. The boys planted a bed of lettuce 8 feet wide and 40 feet long; a bed of radishes 3 feet wide and $14\frac{1}{2}$ feet long; 2 beds of onions each 4 feet wide and 40 feet long. How much area was covered by each bed? How much by all?

7. A concrete walk 9 feet wide was laid on the front of the schoolhouse lot, which was one of the longer sides. Find the cost at \$.45 a square yard.

8. The schoolhouse cellar was 80 feet by 90 feet by 15 feet. How many cubic yards did it contain?

9. If the house was set 2 feet above the ground and the wall inclosing the cellar was 2 feet thick, how many cubic feet of earth were removed to make the cellar?

MEASUREMENT

Oral Exercise

232. 1. A horse travels from G to F on Monday, 25 miles, from F to P on Tuesday, 18 miles. How far does he travel both days?

2. A four-sided pasture has the following length of sides: 7 rods, $5\frac{1}{2}$ rods, 7 rods, $2\frac{1}{2}$ rods. How far is it around the pasture?

3. A house has the following-sized floors to carpet: 40 square yards, 20 square yards, 15 square yards, and 10 square yards. How many square yards of carpet are needed?

4. How many inches are there in 6 feet 9 inches?

5. How long must a box cover be to contain 240 square inches if it is 12 inches wide?

6. From 30 feet take 5 yards.

7. How far does a dog travel in 5 days if he averages 80 miles a day?

8. If there is one cord in a pile of wood 8 feet long by 4 feet wide by 4 feet high, how much is there in a pile 36 feet long by 4 feet wide by 4 feet high?

9. A bicycle rider rode 50 miles a day for $10\frac{1}{4}$ days. How far did he ride?

There are how many:

10. Square inches in 1 sq. ft.?
11. Square feet in 1 sq. yd.?
12. Cubic inches in 1 cu. ft.?
13. Cubic feet in 1 cu. yd.?

14. What is the volume of a chest that measures 1 foot by 2 feet by 6 feet?

15. How many square yards of concrete will cover a walk $6\frac{1}{2}$ feet wide and 12 feet long?

Written Exercise

233. **1.** There are in 3 pieces of cloth $25\frac{3}{8}$ yards, $23\frac{1}{6}$ yards, $18\frac{3}{4}$ yards. How many yards are there in all?

2. How many cubic inches equal 1 gallon? How many gallons will a tank hold that is 26 in. long, 16 in. wide, 16 in. deep?

3. How many miles are there in 1600 rods?

4. How many rods are there in 330 feet?

5. From a piece of cloth that contains 56 yards, there are sold $15\frac{1}{2}$ yards, $10\frac{1}{4}$ yards, and $6\frac{1}{8}$ yards. How much is left? How much is it worth at 15¢ a yard?

6. How many feet are there in .1 of 450 rods?

7. How many times are 20 feet contained in 1 mile?

8. How many times does a wheel revolve in going 20 rods if the distance around it is $8\frac{1}{4}$ feet?

9. The surface of a cube contains 864 square inches. What is the length of one edge?

10. The area of a rectangle is 60 square feet. It measures 16 feet one way. What does it measure the other way?

11. 5 square feet is what per cent of a square yard?

12. How many square feet are there in a mirror 18 in. by 22 in.?

13. What is the volume of a 15-inch cube? How many cubic feet does it contain?

14. If a cart load of earth measures 1 cubic yard, how many loads must be removed for a cellar 40 feet by 16 feet by $11\frac{1}{2}$ feet?

15. A bin is 6×4 feet at the bottom. To what depth will it be filled by 40 bushels of grain, $1\frac{1}{4}$ cubic feet to a bushel?

Oral Exercise

234. **1.** A bushel of wheat weighs 60 pounds. What is the weight of 1 peck? of 3 pecks?

2. $33\frac{1}{3}\%$ of a number is what part of it? What is $33\frac{1}{3}\%$ of 1500 pounds of soap?

3. 75% of a number is what part of it? If 75% of the weight of potatoes is water, how many pounds of water are there in a bushel of potatoes weighing 60 pounds?

4. A gallon of water weighs approximately 8 pounds. How much do $3\frac{1}{2}$ gallons weigh?

5. 25% is what part of a number? What is 25% of 1260 pounds?

6. Change $2\frac{1}{4}$ pounds to ounces; 56 ounces to pounds.

7. How many tons are there in 5000 pounds?

8. Change to improper fractions: $5\frac{3}{4}$, $1\frac{7}{8}$, $4\frac{5}{6}$, $1\frac{15}{16}$.

9. If 9 lb. of sugar cost 54¢, what is the price per pound?

10. How much will $12\frac{3}{4}$ lb. cost at the same price as in Ex. 9?

11. If 4 tons of hay cost $48, what is the price per ton?

12. If hay cost $1 per hundred pounds, what is the price per ton?

13. How many pounds are there in 96 oz.? in 20 oz.? in 24 oz.?

14. How much does a 6-lb. chicken sell for at $16\frac{2}{3}$¢ a pound?

15. What is the cost of $4\frac{1}{2}$ pounds of sirloin steak at 25¢ per pound?

Written Exercise

235. **1.** If it takes 500 pounds of fertilizer for 1 acre of potatoes, how many tons must be used on 8.25 acres?

2. Change 3 tons 615 pounds to pounds; to ounces.

3. At 16 pounds to the ream, how many reams of paper will weigh $\frac{1}{4}$ of a ton?

4. At 10 pounds to the square foot, how much will the slate roofing weigh on a roof measuring 45 feet long and having rafters 18 feet long?

5. What is the selling price of 1400 pounds of coal at \$5.60 per ton?

6. Find the sum of 5 T. 11 cwt. 3 lb., 7 T. 6 cwt. 60 lb., and 8 T. 5 cwt. 40 lb.

7. A lot of wheat weighs $\frac{1}{2}$ ton. If a bushel weighs 60 pounds, how many bushels are there in the lot?

8. What is the value of 1 T. 16 cwt. of hay at \$20 per ton?

Write bills and receipt them for the following items:

9.

5 doz.	Eggs	@ 24¢
4 lb.	Butter	@ 30¢
2 bu.	Potatoes	@ 80¢
4 cans	Tomatoes	@ 15¢
1 lb.	Coffee	@ 38¢
2 gal.	Kerosene	@ 14¢

10.

5 lb.	Raisins	@ 18¢
3 qt.	Cream	@ 35¢
$1\frac{3}{4}$ lb.	Cheese	@ 16¢
$1\frac{1}{2}$ lb.	Citron	@ 52¢
$1\frac{1}{2}$ doz.	Lemons	@ 14¢
7 bars	Soap	@ $5\frac{1}{2}$¢

11. A 60-foot steel rail weighs 1440 pounds. What is its weight per linear foot? per linear yard?

12. If 32 pounds of cheese cost \$4.80, what is the price per pound?

Oral and Sight Exercise

236. 1. A dealer sells cherries at 6¢ a quart. How much is this for a peck?

2. What part of a number is 25% of it? 50%? 75%? $33\frac{1}{3}$%? $66\frac{2}{3}$%?

3. What part of a number is $12\frac{1}{2}$% of it? $37\frac{1}{2}$%? $62\frac{1}{2}$%? $87\frac{1}{2}$%? $16\frac{2}{3}$%?

4. How many quarts are there in 50% of 1 gallon? in 25%? in 75%? in $12\frac{1}{2}$%? in $62\frac{1}{2}$%?

5. How many quarts are there in 25% of a bushel? in $12\frac{1}{2}$%?

6. How many pecks are there in 50% of a bushel? in 75%?

7. What is the cost of a barrel of pork (200 lb.) at $7\frac{1}{2}$¢ a pound?

8. How many bottles, each containing $\frac{1}{6}$ quart, can be filled from $2\frac{1}{3}$ quarts?

9. Find the sum of 2 bushels 1 peck and 1 bushel 3 pecks. Find the difference.

10. Find the sum of 10 gallons 2 quarts and 2 gallons 3 quarts. Find the difference.

11. Multiply 4 gal. 3 qt. by 4; by 5; by 10.

12. Divide 6 bushels 3 pecks by 3; by 2; by 6.

13. What is the daily cost of the milk and cream for a family that uses 2 quarts of milk that costs 6¢ a quart and $\frac{1}{2}$ pint of cream that costs 40¢ a quart?

14. If a train runs 357 miles in 7 hours, what is its average speed per hour?

Written Exercise

237. 1. What is the cost of 12 gal. of sirup at 21¢ a gallon?

2. A barrel of oil containing 50 gallons is sold for $6. What is the price per gallon?

3. What is the cost of 48 qt. of cranberries at 75¢ a peck?

4. If $2\frac{1}{2}$ hours' work cost $2, what is the cost per hour?

5. Find the prime factors of 6; of 60; of 144.

6. If 5 bbl. of apples cost $12.50, how much will 6 bbl. cost?

7. Add $15\frac{5}{8}$ and $8\frac{7}{16}$ to $18\frac{3}{4}$.

8. From $12\frac{3}{8}$ take $\frac{1}{6}$ of 45.

9. If I buy 10 barrels of apples at $2 a barrel, and sell the lot at a discount of 20%, what is the discount? How much do I get for the lot?

10. How many bushels of wheat would a farmer raise on 56 acres at an average yield of $26\frac{1}{2}$ bushels to the acre?

11. How many cubic inches are there in a tank containing 140 gal.?

12. If a spring has a flow of 74 gallons each day, in how many days will it fill 55 casks of 100 gallons each?

13. A 42-gallon barrel is filled with kerosene. At 4¢ a quart, for how much does the oil sell?

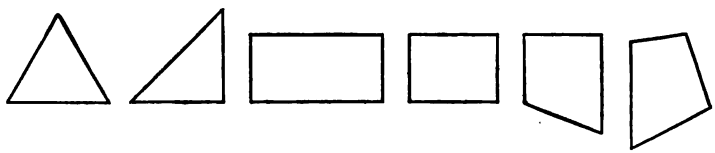
14. A barrel of oil bought at 10¢ a gallon sells at a gain of 50%. If the gain on the barrel is $2.10, how many gallons does the barrel contain?

15. A circle contains 360°. The spokes in a wheel number 16. How many degrees apart are they from center to center?

16. How many inches apart are the centers of the spokes, example 15, at the rim of the wheel, the length of the rim being $11\frac{3}{8}$ ft.?

Oral Exercise

238. 1. The shortest distance between two points is a **straight line.** What kind of lines inclose these figures?



239. The difference in direction of two straight lines that meet is called an **angle.** If, when the lines meet, they form a square corner, the angle is called a **right angle.** An angle less than a right angle is called an **acute angle.** An angle greater than a right angle is called an **obtuse angle.**

240. Any figure bounded by straight lines is called a **polygon.**

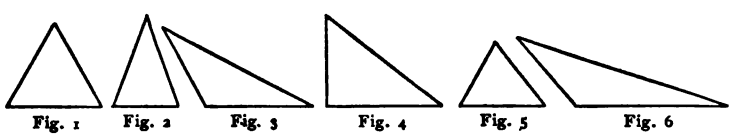


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6

241. Any figure bounded by three straight lines is called a **triangle.**

242. A triangle having three equal sides is called an **equilateral triangle** (Fig. 1). From the equality of angles it is called **equiangular.** A triangle having two equal sides is called an **isosceles triangle** (Fig. 2); and a triangle having three unequal sides is called a **scalene triangle** (Fig. 3).

243. A triangle having one right angle is called a **right-angled triangle** (Fig. 4); a triangle having three acute angles is called an **acute-angled triangle** (Fig. 5); and a triangle having one obtuse angle is called an **obtuse-angled triangle** (Fig. 6).

244. The sum of the bounding lines of any straight-lined figure is called its **perimeter.**

Oral Exercise

245. A figure bounded by four straight lines is a **quadrilateral.**

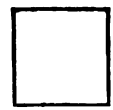


FIG. 1

1. What kind of angles have Figs. 1 and 2?

246. A quadrilateral whose angles are right angles is called a **rectangle.**

FIG. 2

2. How do the lines on the opposite sides of Figs. 1 and 2 compare in their direction?

247. Such lines are called **parallel lines.**

248. A quadrilateral whose opposite sides are parallel is called a **parallelogram.**

249. A quadrilateral having all its angles oblique, *i.e.* not right angles, and its opposite sides parallel, is called an **oblique-angled parallelogram.**

3. How do the sides of Fig. 1 compare in length?

4. What is a rectangle called whose sides are all equal? two of whose opposite sides only are equal?

250. A quadrilateral that has only two of its sides parallel is called a **trapezoid.**

251. The side upon which a figure is assumed to stand is called its **base.**

252. When one line meets another so that the angles adjacent, *i.e.* lying together, are right angles, the lines are said to be **perpendicular** to each other.

253. The height of any figure measured from its highest point on a line perpendicular to its base is called its **altitude.**

254. The *base* and *altitude* of triangles and quadrilaterals are the two dimensions we must know before their areas can be found.

Oral Exercise

255. 1. What is the perimeter of a triangle whose sides are $3\frac{1}{2}$ feet, $4\frac{3}{4}$ feet, and 5 feet?

2. What is the perimeter of an equilateral triangle if each side is $5\frac{3}{5}$ inches?

3. If the perimeter of an equilateral triangle is 10 yards, what is the length of each side in feet?

4. A rectangular field is 23 rods long and 15 rods wide. How many rods of fence will inclose the field?

5. It requires 72 rods of fence to inclose a square field. How long is a side of the field?

6. One side of a triangle is $10\frac{1}{2}$ feet and a second side is $8\frac{1}{4}$ feet. What is the length of the third side if the perimeter is 25 feet?

7. The perimeter of a triangle is 18 inches. One side is 7 inches and the other two sides are equal. How long is one of the equal sides?

8. How long is the side of an equilateral triangle whose perimeter is 9 inches? $7\frac{1}{2}$ inches? 2 feet 3 inches?

9. What is the perimeter of an oblong $5\frac{1}{4}$ inches by 3 inches?

10. What is the perimeter of a rectangle each side of which measures $11\frac{1}{5}$ inches?

11. What is the perimeter of a parallelogram whose base is 9 feet and one of its adjacent sides $7\frac{1}{2}$ feet?

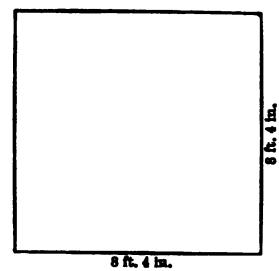
12. Make a diagram on the scale of $\frac{1}{4}$ inch to 1 foot representing a rectangle 9 ft. by $7\frac{1}{2}$ ft. Draw another of twice these dimensions and tell how the two diagrams compare in size.

Written Exercise

256. 1. Draw a rectangle 4 inches by 3 inches and describe it.

Thus, this rectangle is a ——, it is —— inches long, —— inches wide; its perimeter is —— inches.

2. Describe the figure drawn at the right, giving its special name.

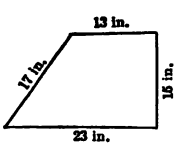


3. Give this figure three other names.

4. Draw a quadrilateral that has only two of its sides parallel. Is it a parallelogram? Give its special name.

5. What is the perimeter of an equilateral triangle $28\frac{1}{8}$ inches on a side?

6. One side of an isosceles triangle is 40 feet, and one of the equal sides is 25% longer. Find the perimeter of this triangle.



7. Draw to a scale of $\frac{1}{4}$ in. to the inch a quadrilateral whose sides are 13 inches, 15 inches, 23 inches, and 17 inches respectively. The special name given to this figure is **trapezium**.

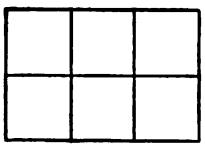
8. Find the perimeter of this trapezium.

9. Two of the sides of a triangle are 34 in. and 45 in. The perimeter is 100 in. What is the length of the third side? What name is given to this kind of a triangle?

10. A ship sails north 97 miles, then southeasterly 117 miles. How far must it sail in a direct line, to reach the starting point, if the whole distance sailed is 301 miles?

11. How many angles of .9° can be made around one point?

Oral Exercise



257. 1. If the figure in the margin represents a rectangle 3 inches long and 2 inches wide, how many square inches does the rectangle contain?

Solution. A rectangle 1 in. long, 1 in. wide, contains 1 sq. in. A rectangle 3 in. long, 1 in. wide, contains 3 sq. in. A rectangle 3 in. long, 2 in. wide, contains 2 times 3 sq. in., or 6 sq. in.

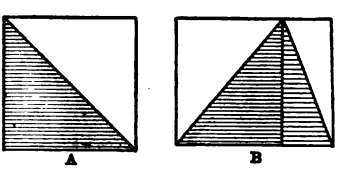
2. How do we find the area of a rectangle?

Give the areas of rectangles measuring as follows:

3. 5 inches by 7 inches.
4. 9 feet by 8 feet.
5. 8 yards by 7 yards.
6. $5\frac{1}{2}$ inches by 4 inches.
7. $6\frac{1}{3}$ feet by 6 inches.
8. $2\frac{1}{2}$ feet by $1\frac{1}{2}$ feet.

9. What two dimensions must you know in a rectangle before you can find its area?

10. What figure is represented by the shaded parts of the rectangles *A*, *B*?



11. How do the areas of the triangles compare with the areas of their rectangles?

12. How, then, can we find the area of a triangle if we know the length of its base and altitude?

Remember that, *The area of a triangle equals half the area of a rectangle of the same base and height.*

Give the areas of triangles measuring as follows:

	Base	Altitude		Base	Altitude
13.	7 ft.	9 ft.	16.	12 in.	$4\frac{1}{3}$ in.
14.	$4\frac{1}{2}$ ft.	5 ft.	17.	16 ft.	$7\frac{7}{8}$ ft.
15.	$10\frac{3}{4}$ in.	6 in.	18.	5 rd.	12.2 rd.

Written Exercise

258. Find the areas of parallelograms whose dimensions are:

1. $27\frac{3}{4}$ in. by 19.5 in.
2. $47\frac{7}{8}$ ft. by $17\frac{3}{4}$ ft.
3. 16 ft. by 12 ft. 3 in.
4. 14 rd. by 97 ft.
5. $9\frac{1}{2}$ yd. by $16\frac{3}{4}$ ft.
6. $75\frac{1}{2}$ rd. by 42 rd.

Find the areas of triangles whose dimensions are:

7. Base 23 ft. Altitude $1\frac{1}{2}$ ft.
8. Base 32 ft. 6 in. Altitude 17 ft.
9. Base 18.75 in. Altitude 14.875 ft.
10. Base $5\frac{1}{2}$ rd. Altitude 40 ft.

11. How many acres are there in a rectangular field 145 rods long and 86 rods wide?

12. A city lot in the shape of a triangle has a base of 82 feet and an altitude of $25\frac{1}{2}$ feet. What is the value of the lot at $\$5.50$ a square foot?

13. How many paving blocks 8 inches by 2 inches will be needed to pave a street 250 feet long and 40 feet wide, making no allowance for spaces between the blocks?

14. What is the cost of concreting a walk $82\frac{1}{2}$ inches by 60 inches at $\$0.70$ a square yard?

15. How many square feet of glass will be needed for 6 windows, if each window contains 18 panes 14 in. by 10 in.?

16. A field 18 rods long and 16 rods wide contains how many square rods? how many acres?

17. How many square feet are there in an acre of land? in $\frac{3}{8}$ of an acre?

18. What fraction of an acre is there in a rectangular house lot 150 feet wide and 250 feet long?

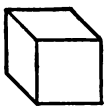


Fig. 1

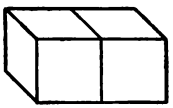


Fig. 2

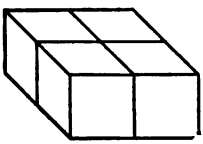


Fig. 3

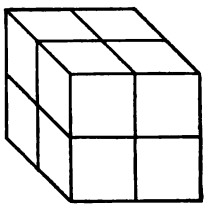


Fig. 4

Oral Exercise

259. 1. If Fig. 1 equals 1 cubic inch, what is the volume of Fig. 2? of Fig. 3?

2. Explain the process by which the volume of Fig. 4 is found.

3. How should you find the volume of a box 5 feet by 4 feet by 2 feet?

Find the volume of solids whose dimensions are as follows:

4. 6 in. by 4 in. by 1 in.
5. 6 in. by 4 in. by 2 in.
6. $6\frac{1}{2}$ in. by 4 in. by 5 in.
7. 8 in. by 9 in. by 3 in.

8. Find the volume of a bar of soap 5 inches long, 3 inches wide, and $2\frac{1}{2}$ inches thick.

9. How many cubic feet of ice will fill a box 5 feet by 2 feet by 8 feet?

10. How many cubic feet of air are there in a room 36 feet long, 32 feet wide, and 14 feet high?

11. How many cubic inches of sand will a box 9 inches square on the bottom and 5 inches deep hold?

Written Exercise

260. 1. How many cubic feet of stone are there in a wall 27 feet long, 5 feet high, and $1\frac{1}{2}$ feet thick?

2. A cubic foot of water weighs $62\frac{1}{2}$ pounds. What is the weight of water that a cistern may contain which measures on the inside 4 feet in length, 3 feet in width, and 4 feet in depth?

3. How many cords of wood are there in a pile 22 feet long, 4 feet wide, and 4 feet high?

4. How many cords are there in a load of wood 6 feet 8 inches wide, 6 feet high, and 8 feet long?

5. How many bushels are there in a bin 8 feet by 6.5 feet by 4 feet?

6. Mr. James dug a cellar of the following dimensions: 12 feet by 15 feet by 8 feet. How many cubic yards of earth were removed?

7. Cost of digging this (example 6) cellar at 49¢ a cubic yard?

8. A wagon-body 6 feet by 4 feet by 2 feet will hold how many bushels of beans, $1\frac{1}{4}$ cu. ft. to a bushel?

9. An iron tank is 27 feet square at the bottom and 19 feet deep. How many barrels of water will it hold? (231 cu. in. = 1 gal.)

10. Find the cubical contents of a schoolroom 32 ft. long, 30 ft. wide, 9 ft. high, and tell how many cubic feet of air space each pupil has if the room contains 6 rows of 9 pupils each.

11. If the above room has 4 windows of 48 sq. ft. each, to what part of the floor surface is the lighting surface equal?

PART II

ELEMENTARY COMBINATIONS

Oral Exercise

261. Add from the bottom upward; to prove, add in the reverse order:

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
6	4	1	6	6	8	6	7	7	9
2	5	8	3	6	7	6	5	9	3
6	5	4	5	4	3	8	3	5	8
7	4	4	3	2	5	2	6	7	2
2	3	5	7	9	4	5	4	3	6
7	5	8	6	6	4	8	7	9	2
4	7	8	7	2	3	1	5	3	6
3	9	2	8	7	1	4	3	8	3

11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
6	3	1	5	6	2	4	7	1	9
9	7	2	3	8	3	3	4	8	4
2	6	2	3	3	1	9	3	9	9
5	6	1	2	6	5	2	2	3	9
7	4	3	4	4	4	8	1	1	5
9	2	2	1	2	3	7	8	9	8
4	6	1	2	1	3	5	2	8	9
5	1	5	3	3	2	4	4	5	8
8	3	2	7	5	1	1	2	7	8
8	3	3	3	2	4	2	5	6	6

Add the following in columns and in line:

	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	33.	34.	35.
36.	6	7	8	13	8	7	15	13	6	9	15	6	7	3	13
37.	12	8	12	8	9	6	8	9	12	6	7	7	15	10	17

Written Exercise

262. 1. The population of the world by races being approximately as follows, find the world's total population:

White race,	610,500,000	Red race,	15,000,000
Yellow and Brown,	665,000,000	Black race,	150,150,000

2. What was the total amount received from the sale of United States public lands in the decade from 1890 to 1900 if the sales were as follows?

1890 . . .	$6,358,273	1895 . . .	$1,103,347
1891 . . .	4,029,535	1896 . . .	1,005,523
1892 . . .	3,261,876	1897 . . .	864,581
1893 . . .	3,182,090	1898 . . .	1,243,129
1894 . . .	1,673,637	1899 . . .	3,070,137

3. The approximate annual cereal product of the United States being divided as follows, what is the total?

Wheat,	625,000,000 bu.	Rice,	41,600,000 bu.
Corn,	2,094,000,000 "	Flaxseed,	25,000,000 "
Oats,	823,000,000 "		

4. What is the total annual value of the animal products of the United States, the details being as follows?

Cattle,	$1,518,000,000	Hogs,	$239,000,000
Sheep,	$170,000,000	Horses and Mules,	$1,266,000,000
Raw Wool,	$90,000,000	Fish and Oysters,	$59,000,000

5. Find the total population of the five largest cities of the world, the populations being as follows:

London,	4,537,000	Canton,	900,000
New York,	4,013,781	Chicago,	1,698,575
Paris,	2,763,000		

Oral Exercise

263. Count backward:

1. By 3's from 61 to 1
2. By 7's from 55 to 6
3. By 6's from 52 to 4
4. By 8's from 99 to 3
5. By 9's from 83 to 2
6. By 5's from 72 to 2
7. By 4's from 89 to 1
8. By 7's from 70 to 0

Subtract at sight:

	a	*b*	*c*	*d*	*e*
9.	17 – 2	9 – 4	18 – 6	13 – 5	20 – 7
10.	24 – 7	14 – 6	92 – 11	85 – 21	66 – 38
11.	98 – 25	310 – 14	89 – 45	610 – 49	152 – 55
12.	98 – 33	101 – 76	121 – 54	313 – 56	181 – 37
13.	57 – 45	106 – 85	69 – 26	126 – 44	130 – 41
14.	38 – 15	96 – 83	127 – 31	91 – 13	154 – 21
15.	145 – 26	176 – 67	161 – 78	137 – 78	130 – 86
16.	158 – 77	120 – 95	117 – 56	111 – 29	129 – 68
17.	142 – 89	172 – 49	154 – 98	103 – 89	115 – 39
18.	141 – 88	166 – 99	157 – 89	125 – 35	62 – 15
19.	148 – 59	162 – 83	133 – 96	146 – 48	157 – 88

Find the difference between:

20.	\$2 and \$1.24	27.	\$10 and \$3.64	34.	\$50 and \$13.80
21.	\$1 and \$0.46	28.	\$10 and \$7.50	35.	\$50 and \$37.50
22.	\$3 and \$1.18	29.	\$10 and \$1.38	36.	\$50 and \$17.35
23.	\$5 and \$3.50	30.	\$10 and \$5.18	37.	\$25 and \$21.73
24.	\$2 and \$0.83	31.	\$15 and \$7.29	38.	\$50 and \$18.75
25.	\$5 and \$4.07	32.	\$20 and \$17.06	39.	\$70 and \$62.50
26.	\$4 and \$3.23	33.	\$20 and \$14.67	40.	\$40 and \$33.34

Written Exercise

264. 1. The island of Newfoundland has an area of 42,730 square miles. Cuba has an area of 44,015 square miles. Which is the larger in area, and how much?

2. New York City has a population of 4,013,781; Switzerland, a population of 3,325,000. Which has the larger population, and how much does it exceed the other?

3. Australia had in 1901 a population of 3,983,000. London had 4,537,000. How much greater was London's population?

4. The value of the gold production of the United States in one year was approximately $80,000,000. The value of the production of distilled liquors was $97,000,000. Which is the larger sum? How much larger is it?

5. The value of the imports into the United States in a certain year was $1,025,719,000. The value of exports in the same year was $1,392,231,000. Which was the larger value, and how much?

6. From Duluth to Buffalo by way of the Great Lakes is 1050 miles. From Buffalo to Troy by the Erie Canal is 387 miles. From Troy to the ocean at New York City is 150 miles. How long is the entire distance from Duluth to New York City? The distance from Duluth to the ocean by the Great Lakes and St. Lawrence River is 2384 miles. Which route from Duluth to the ocean is the shorter, and how much?

7. France has an area of 207,217 square miles. Germany has 210,232 square miles. Which is larger in area, and how much?

8. Find the approximate length of the Panama Canal, the distances being approximately as follows: Colon to Gatun locks, 7 miles; to Gatun dam, 26 miles; to Culebra cut, 2 miles, and through it, 9 miles; to Panama, 7 miles.

Oral and Written Exercise

265. 1. Multiply each of the following numbers by 3:

6, 3, 7, 4, 9, 5, 2, 15, 8, 10, 12 10.
60, 30, 70, 40, 90, 50, 20, 25, 80, 100, 120, 110.

2. Multiply each of the numbers in example 1, by 5, by 6, by 4, by 7, by 2, by 8, by 9, by 10, by 11, by 12.

3. Compare the products of 5×16 and 16×5. In the same way compare the products of 3×15 and 15×3, 18×2 and 2×18. What general fact do you thus discover? The principle may be stated thus:

The product of two or more factors is always the same in whatever order the factors are arranged.

4. At \$35 each, what is the cost of 5 sewing machines? At \$5 each, what is the cost of 35 sheep?

5. What is the total allowance for 6 second-hand typewriters at \$24 each? What is the cost of 24 hats at \$6 each?

6. How many books are there in 7 boxes containing 150 books each? How many books are there in 150 sets of 7 books each?

7. How many hours are there in a week? days in 24 weeks?

8. How many minutes are there in a day and night?

9. How many pounds of butter are there in 5 tubs of 50 pounds each? in 50 boxes of 5 pounds each?

10. What is the cost of 200 pounds of sugar at 5¢ a pound?

11. Make a bill and receipt for:

19 boxes Oranges at \$4 per box.
60 bunches Bananas at \$2 per bunch.
32 boxes Grapes at \$1 a box.
250 Melons at 12¢ per melon.

Written Exercise

266. 1. From Hartford, Connecticut, to Boston, Massachusetts, by rail is 117 miles. How many miles does an engineer cover in a week of 6 days, if he makes the round trip daily?

2. At 2 cents a mile, what would be the railroad fare from New Haven to San Francisco, a distance of 3322 miles?

3. If a ticket to go and return is sold at $1\frac{1}{2}$ times the above rate, how much does the round-trip ticket cost?

4. What is the total amount paid for one year in salaries to 130 persons receiving an average salary of $800 per year?

5. At a yearly cost of $2.20 per pupil to furnish text books and stationery, what is the total cost for 11,474 pupils?

6. There are about 206,000 square miles in Central America. If there are, on an average, 20 persons to each square mile, what is the total population?

7. Cuba is 730 miles long and has an average width of 55 miles. What is its approximate area?

8. Haiti has an area of about 11,000 square miles. The area of Great Britain and Ireland is 11 times as great. Give the area of Great Britain and Ireland.

9. On a desk-top measuring 18 inches by 24 inches, what is the total downward pressure of the atmosphere if it is approximately 15 pounds for each square inch?

10. How many bushels of potatoes, 60 pounds each, are there in 3 tons 750 pounds?

11. How many bushels of potatoes, allowing 2500 cubic inches of space to a bushel, will a car contain that measures inside 36 feet by 8 feet wide by 8 feet high?

Oral Exercise

267. Divide at sight:

	a	*b*	*c*	*d*
1.	81 by 9	64 ÷ 4	18 ÷ 6	12's in 24
2.	42 by 6	87 ÷ 3	72 ÷ 9	2's in 98
3.	95 by 5	85 ÷ 5	22 ÷ 11	8's in 56
4.	54 by 6	39 ÷ 3	100 ÷ 50	12's in 96
5.	69 by 3	66 ÷ 11	49 ÷ 7	5's in 45
6.	48 by 6	88 ÷ 2	26 ÷ 13	14's in 28
7.	96 by 3	75 ÷ 25	94 ÷ 2	25's in 125
8.	75 by 5	64 ÷ 16	42 ÷ 6	16's in 80
9.	88 by 8	45 ÷ 15	90 ÷ 30	9's in 63

10. In 360 minutes there are how many hours? in 3600 minutes?

11. At the rate of 20 pounds for one dollar, what is the cost of one pound of sugar? of 5 pounds?

12. What is $\frac{1}{12}$ of 96? of 84? of 144?

13. A house worth $10,000 is insured for $\frac{1}{2}$ of its value. For how much is it insured?

14. Divide 48 dollars into two parts so that one part has twice as many dollars as the other part.

15. Change 44 pecks to bushels.

16. Change 96 quarts to bushels.

17. How many pounds equal 48 ounces?

18. At a rate of 40 miles an hour, how long will it take a train to travel 260 miles?

19. The perimeter of a square measures 144 feet. What is the length of one side?

Written Exercise

268. 1. How many hours will it take to ride 3208 miles at the rate of 16 miles an hour?

2. The total cost of a European trip is $500 for 90 days. What is the average cost per day?

3. In a period of 200 months there are how many years?

4. How many miles must a man travel each day to cover 1800 miles in 14 days?

5. $2592 is paid for cotton mattresses at $8 apiece. How many are purchased?

6. Divide 9644 by 31; by 47; by 59.

7. How many mills are there in one dollar? How many dollars are there in 247,981 mills?

8. It costs $70 to pay for 1 ton of paper. What is the rate per pound?

9. What is the average weight of each of 16 persons whose weights equal 1760 pounds?

10. A salesman by being late loses a total of 2 hours and 5 minutes during a week of 6 days. What is the average loss per day in minutes?

11. The area of a floor is 66 square yards. Its width is 78 feet. What is its length?

12. There are 3 rectangular lots of land adjoining and fronting upon a straight street. The front of each lot is 50 feet, the depth 100 feet. Draw a plan of the lots, and find how many feet of board will be required for a tight fence 4 feet high to inclose and separate these lots.

Oral and Sight Exercise

Review pages 35, 36.

269. 1. Give an example of a prime number; of a composite number.

2. Name the prime factors of 8, 12, 15, 16, 18, 21.

3. Find the product of 8 multiplied by 10; of 8 multiplied by the prime factors of 10. How do the results compare?

4. Multiply 25 by 24 by using the factors of 24; *i.e.* $2 \times 2 \times 2 \times 3$. Divide 60 by 12, using the factors of 12.

5. Multiply and divide 60 by 15 by using the factors of 15.

6. Divide 80 by 20 and by 16, using their factors.

Change to their lowest terms:

7. $\frac{10}{12}$ 9. $\frac{6}{8}$ 11. $\frac{15}{20}$ 13. $\frac{18}{24}$

8. $\frac{8}{10}$ 10. $\frac{4}{6}$ 12. $\frac{9}{15}$ 14. $\frac{5}{20}$

Written Exercise

270. 1. Find the greatest common factor (or divisor) of 12 and 48; of 54 and 96.

2. Find the g. c. d. of 324 and 134; of 225 and 396.

3. Find the g. c. d. of 668 and 746; of 840 and 1200.

Reduce the following to their lowest terms by dividing the numerator and denominator by their g. c. d.

4. $\frac{21}{24}$ 7. $\frac{80}{100}$ 10. $\frac{91}{156}$ 13. $\frac{510}{654}$

5. $\frac{27}{80}$ 8. $\frac{72}{90}$ 11. $\frac{110}{275}$ 14. $\frac{432}{518}$

6. $\frac{24}{32}$ 9. $\frac{68}{105}$ 12. $\frac{125}{600}$ 15. $\frac{247}{969}$

Oral and Sight Exercise

Review page 37.

271. 1. Name four multiples of 6; of 9; of 16.

2. Name the l. c. m. of 6 and 9; of 10 and 6; of 5 and 8; of 5, 4, and 10; of 6, 4, 3.

At sight, change the following to equivalent fractions having the least common denominator:

3. $\frac{1}{5}, \frac{3}{10}, \frac{7}{20}$

4. $\frac{1}{3}, \frac{5}{6}, \frac{3}{9}$

5. $\frac{1}{2}, \frac{3}{4}, \frac{1}{12}$

6. $\frac{1}{4}, \frac{2}{3}, \frac{5}{12}$

7. $\frac{3}{8}, \frac{1}{12}, \frac{5}{16}$

8. $\frac{4}{9}, \frac{2}{3}, \frac{5}{18}$

Written Exercise

272. Find the least common multiple of:

1. 13, 26, 39, 156
2. 8, 12, 18, 20
3. 11, 44, 132, 198
4. 11, 22, 55, 110
5. 14, 18, 20, 21
6. 20, 28, 56, 70
7. 17, 34, 51, 85
8. 50, 60, 63, 84
9. 10, 14, 15, 18
10. 24, 26, 28, 30

Change to equivalent fractions having the least common denominator:

11. $\frac{9}{8}, \frac{11}{12}, \frac{17}{18}$

12. $\frac{6}{14}, \frac{11}{15}, \frac{13}{18}$

13. $\frac{8}{13}, \frac{13}{39}, \frac{17}{26}$

14. $\frac{19}{44}, \frac{19}{22}, \frac{26}{33}$

15. $\frac{3}{18}, \frac{23}{28}, \frac{1}{56}$

16. $\frac{8}{45}, \frac{7}{15}, \frac{11}{18}, \frac{7}{10}$

17. $\frac{3}{8}, \frac{7}{12}, \frac{5}{18}, \frac{9}{20}$

18. $\frac{8}{11}, \frac{13}{44}, \frac{26}{132}, \frac{23}{60}$

19. $\frac{5}{14}, \frac{13}{22}, \frac{14}{55}, \frac{3}{70}$

20. $\frac{9}{20}, \frac{13}{28}, \frac{9}{56}, \frac{11}{70}$

Oral and Sight Exercise

Review pages 44, 71.

273. 1. A man owed $9, which was $\frac{3}{4}$ of what he earned in a week? How much did he earn in a week?

2. 9 is $\frac{3}{4}$ of what number? $\frac{3}{5}$ of what number? $\frac{3}{10}$ of what number?

3. 10 is $\frac{2}{3}$ of what number? $\frac{2}{5}$ of what? $\frac{2}{7}$ of what? $\frac{2}{9}$ of what?

4. How many 1's are there in 24 sixths? in 24 eighths? in 24 thirds?

5. What part of 1 bushel is 1 peck? are 3 pecks? 16 quarts?

Add at sight:

6. $6\frac{1}{2} + 8\frac{1}{4}$
7. $12\frac{1}{2} + 1\frac{5}{8}$
8. $20\frac{1}{8} + 3\frac{1}{4}$
9. $13\frac{7}{8} + 4\frac{3}{4}$
10. $15\frac{5}{6} + 6\frac{1}{3}$
11. $3\frac{1}{5} + 5\frac{9}{10}$

Written Exercise

274. Add:

1. $5\frac{1}{8}$, $15\frac{1}{2}$, $12\frac{1}{2}$, $26\frac{1}{8}$

2. $10\frac{3}{4}$, $4\frac{1}{2}$, $9\frac{1}{4}$, $40\frac{7}{8}$

3. $51\frac{5}{8}$, $8\frac{3}{6}$, $6\frac{3}{4}$, $35\frac{5}{8}$

4. $52\frac{5}{12}$, 248, $4\frac{3}{4}$, $16\frac{5}{6}$

5. $95\frac{1}{10}$, $91\frac{4}{15}$, $60\frac{2}{3}$, $48\frac{5}{6}$

6. 820, $75\frac{5}{9}$, $3\frac{2}{3}$, 60

7. $132\frac{3}{4}$, $101\frac{1}{6}$, $39\frac{11}{12}$, 90

8. $59\frac{1}{6}$, $34\frac{7}{12}$, $17\frac{5}{8}$, $6\frac{1}{3}$

9. $\frac{2}{3} + \frac{3}{4} + \frac{1}{6} + \frac{1}{2}$

10. $\frac{4}{5} + \frac{5}{8} + \frac{7}{10} + 1\frac{19}{20}$

11. $11\frac{4}{9} + 1\frac{5}{7} + 3\frac{2}{3} + \frac{20}{21}$

12. $5\frac{3}{9} + \frac{1}{8} + 7\frac{5}{12} + 6\frac{5}{24}$

Oral and Sight Exercise

Review page 45.

275. Subtract at sight:

	a	*b*	*c*	*d*
1.	$\frac{7}{8} - \frac{1}{2}$	$\frac{5}{7} - \frac{5}{14}$	$\frac{1}{10} - \frac{1}{12}$	From $18\frac{11}{12}$ take $5\frac{5}{6}$.
2.	$\frac{3}{8} - \frac{1}{6}$	$\frac{3}{5} - \frac{3}{10}$	$\frac{5}{9} - \frac{4}{9}$	From $16\frac{3}{8}$ take $12\frac{1}{2}$.
3.	$\frac{7}{8} - \frac{3}{4}$	$\frac{5}{6} - \frac{2}{3}$	$\frac{17}{18} - \frac{2}{9}$	From 25 take $8\frac{3}{8}$.
4.	$\frac{3}{4} - \frac{5}{8}$	$\frac{7}{14} - \frac{1}{2}$	$\frac{2}{3} - \frac{3}{5}$	From $31\frac{1}{4}$ take $18\frac{3}{4}$.

Written Exercise

276. 1. From a lot of land containing $75\frac{3}{8}$ acres, $24\frac{3}{5}$ acres are sold. How much remains?

2. Subtract $10\frac{1}{4}$ from $44\frac{3}{8}$.

3. Subtract $35\frac{3}{8}$ from $274\frac{3}{7}$.

4. Subtract $1\frac{2}{15}$ from $4\frac{9}{11}$.

5. From $15\frac{3}{8}$ take $11\frac{3}{4}$.

6. From $4\frac{2}{5}$ take $1\frac{3}{4}$.

7. From $3\frac{19}{48}$ take $2\frac{5}{6}$.

8. The sum of two numbers is 125. One of the numbers is $37\frac{1}{2}$. Find the other number.

9. After a minuend of $\$66\frac{3}{8}$ had a number subtracted from it, there remained $\$18\frac{3}{4}$. What was the number subtracted?

10. From the floor of a room to the ceiling measures $9\frac{1}{2}$ feet. From the top of the mantel to the ceiling is $2\frac{3}{4}$ feet. How high is the top of the mantel from the floor?

11. Shares of stock in the National Lead Company sold during the year 1905 as high as $111\frac{1}{4}$ and as low as $97\frac{5}{8}$. Find the difference.

12. Find the length of a 20-foot rope after it has shrunk $2\frac{3}{4}$ inches.

13. What number will remain if out of $57\frac{5}{8}$ the number $27\frac{6}{7}$ is taken?

Oral Exercise

Review pages 49 and 50.

277. 1. What is the cost of 100 tulip bulbs at $\frac{1}{2}$ cent each?

2. Find the cost of 7 rose bushes at $\$\frac{3}{4}$ each.

3. How do you multiply a fraction by a whole number?

Multiply:

4. $\frac{3}{8}$ by 2
5. $\frac{3}{8}$ by 6
6. $\frac{9}{10}$ by 5
7. $\frac{4}{7}$ by 4
8. $\frac{20}{21}$ by 3
9. $\frac{7}{8}$ da. $\times$ 8
10. $\frac{3}{4}$ lb. $\times$ 12
11. $\frac{3}{8}$ yd. $\times$ 12
12. $\frac{5}{8}$ oz. $\times$ 10
13. $\$\frac{9}{20} \times 9$
14. $\frac{4}{7}$ by 8
15. $\frac{6}{11}$ by 5
16. $\frac{7}{12}$ by 6
17. $\frac{4}{15}$ by 12
18. $\frac{7}{14}$ by 7
19. 4 times $\frac{5}{7}$
20. 8 times $\frac{5}{14}$
21. 3 times $\frac{11}{15}$
22. 10 times $\frac{7}{20}$
23. 7 times $\frac{8}{9}$

24. If 4 yards of cloth can be bought for $1, what is the cost of 8 yards?

25. When $\frac{7}{9}$ of a yard of oilcloth can be bought for $1, how many yards will $5 buy?

26. If each person in a family of 7 eats $\frac{1}{2}$ pound of butter a week, how much will supply the family for the month of February of this year?

27. What is the cost of 12 yards of ribbon at $\$\frac{3}{8}$ a yard?

28. Find the cost of 5 gallons of oil at $11\frac{1}{2}$ ¢ a gallon.

29. In 5 rods there are how many yards? how many feet?

30. At the rate of $8\frac{2}{3}$ bushels of wheat to the half acre, how much will 5 acres yield?

31. If by using 3 machines a lot of grain can be threshed out in $4\frac{1}{2}$ days, what time will it take to thresh it with 1 machine?

Written Exercise

278. 1. Find the total length of 9 pieces of molding, each $6\frac{3}{4}$ feet long.

2. How much is the combined area of 4 pieces of land, each of which contains $10\frac{2}{5}$ acres?

3. Multiply $\frac{1}{11}$ by $(8+9+6)$; \$$4\frac{3}{5}$ by $(13+12)$.

4. At \$$4\frac{3}{4}$ per box, what is the cost of 72 boxes of oranges?

5. Find the cost of 34 thousand bricks at \$$9\frac{1}{2}$ per thousand.

6. At $\frac{3}{4}$ of a dollar per square yard, find the cost of concreting a cellar that is 15 feet by 18 feet.

7. How much is received for 57 bushels of corn at $28\frac{1}{2}$¢ per bushel?

8. In a certain city the birth rate for the last year was $26\frac{1}{10}$ per thousand of the population. What was the total number of births, if there was a total population of 40 thousand?

9. For how much will 7 shares of Erie preferred railroad stock sell at \$$74\frac{7}{8}$ per share?

10. The weight of the lead being $3\frac{1}{2}$ lb. to the square foot, what weight of lead is required to line a tank 4 feet square and 5 feet deep?

11. Going at the rate of $51\frac{2}{5}$ miles per hour, how long will it take a train to go from Richmond, Virginia, to Jacksonville, Florida, supposing the distance to be 661 miles?

12. The side of a square lot of land is 12 rods long. What is its length in feet?

13. Calling $365\frac{1}{4}$ days a year, how many days is it from the beginning of this century to the beginning of this year?

14. Two motor boats are sold, one for \$$92\frac{3}{5}$, the other for \$$160\frac{3}{8}$. How much is received for both?

Oral Exercise

Review pages 51 and 52.

279. 1. At \$10 a month for rent, what is the rent of a house for $\frac{2}{3}$ of a month?

2. At \$20 a ton for hay, what is the cost of $2\frac{1}{5}$ tons?

3. How do you multiply a whole number by a fraction?

Multiply:

4. 8 by $\frac{3}{8}$
5. 10 by $\frac{4}{5}$
6. 7 by $\frac{3}{4}$
7. 6 by $\frac{4}{7}$
8. 9 by $\frac{5}{6}$
9. 7 yr. $\times \frac{2}{5}$
10. 4 lb. $\times \frac{9}{16}$
11. \$11 $\times \frac{3}{10}$
12. 11 T. $\times \frac{11}{20}$
13. 12 hhd. $\times \frac{3}{5}$
14. 6 by $1\frac{5}{8}$
15. 3 by $4\frac{3}{5}$
16. 12 by $8\frac{1}{3}$
17. 8 by $2\frac{3}{16}$
18. 10 by $3\frac{5}{6}$
19. Take $\frac{4}{5}$ of 25.
20. Take $\frac{2}{3}$ of 7.
21. Take $\frac{10}{13}$ of 3.
22. Take $\frac{7}{11}$ of 5.
23. Take $\frac{5}{6}$ of 11.

Written Exercise

280. Find the product of each of the following:

1. $\frac{3}{8}$ of 64
2. $\frac{4}{15}$ of 65
3. $\frac{6}{7}$ of 84
4. $\frac{3}{4}$ of 30
5. $\frac{3}{4}$ of 96
6. $\frac{4}{5}$ of 26
7. $\frac{3}{8}$ of 120
8. $\frac{5}{9}$ of 72
9. $\frac{3}{5}$ of 365 days
10. $\frac{1}{7}$ of 365 days
11. $\frac{3}{5}$ of 158 miles
12. $\frac{7}{22}$ of 176 rods
13. $6\frac{2}{3}$ times 20
14. $32\frac{3}{5}$ times 12
15. $20\frac{5}{7}$ times 5
16. $19\frac{7}{8}$ times 6
17. $96\frac{3}{8}$ times 16
18. $110\frac{5}{17}$ times 16

Find the cost of storing furniture:

19. For $\frac{10}{12}$ year at \$10 a year; at \$5 a year; at \$50.
20. For $2\frac{5}{12}$ years at \$2 a month; at \$3 a month.
21. For $5\frac{9}{30}$ months at \$24 a year; at \$60 a year.

Oral and Sight Exercise

Review pages 53 and 54.

281. 1. The distance between the town hall and the post office is $\frac{1}{2}$ mile. What fraction of a mile is $\frac{1}{3}$ of this distance?

2. The distance between the schoolhouse and the post office is $1\frac{1}{4}$ miles. What is $\frac{1}{3}$ of this distance?

3. How do you multiply a fraction by a fraction?

4. $\frac{1}{2} \times \frac{1}{3}$ 6. $\frac{1}{3}$ of $\frac{5}{6}$ 8. $\frac{2}{3}$ of $\frac{6}{7}$ 10. $\frac{3}{6} \times \frac{9}{10}$ 12. $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{3}{5}$

5. $\frac{1}{4} \times \frac{2}{5}$ 7. $\frac{3}{4}$ of $\frac{3}{5}$ 9. $\frac{3}{5}$ of 10 11. $\frac{3}{5} \times 12\frac{1}{2}$ 13. $\frac{7}{16}$ of $\frac{2}{7}$ of $\frac{5}{8}$

282. Written Exercise

1. $\frac{2}{5}$ of $\frac{3}{8}$ 6. $\frac{1}{14}$ of $\frac{3}{4}$ 11. $\frac{2}{15}$ of $\frac{5}{6}$ 16. $1\frac{3}{4} \times 7\frac{1}{3}$

2. $\frac{1}{8}$ of $\frac{1}{12}$ 7. $\frac{3}{4}$ of $\frac{1}{22}$ 12. $\frac{3}{9}$ of $\frac{11}{33}$ 17. $72\frac{4}{7} \times 17\frac{1}{2}$

3. $\frac{2}{3}$ of $\frac{1}{8}$ 8. $\frac{2}{50}$ of $\frac{3}{7}$ 13. $\frac{3}{8}$ of $\frac{21}{45}$ 18. $75\frac{1}{3} \times 12\frac{3}{5}$

4. $\frac{5}{9}$ of $\frac{3}{4}$ 9. $\frac{5}{9}$ of $\frac{3}{40}$ 14. $\frac{2}{18}$ of $\frac{65}{7}$ 19. $30\frac{1}{4} \times 6\frac{4}{5}$

5. $\frac{7}{8}$ of $\frac{2}{15}$ 10. $\frac{6}{7}$ of $\frac{28}{9}$ 15. $\frac{26}{50}$ of $\frac{75}{91}$ 20. $91\frac{1}{5} \times 9\frac{1}{11}$

21. How many yards are there in $\frac{1}{2}$ rod? in $2\frac{1}{2}$ rods?

22. How many square yards are there in $\frac{1}{3}$ rod? in $3\frac{2}{3}$ rods?

23. How many square yards are there in $\frac{1}{2}$ of a square rod? in $3\frac{1}{7}$ square rods?

24. What is the cost of $8\frac{1}{3}$ square feet of glass at 10 cents a square foot?

25. A desk-top is covered with enameled cloth worth $16\frac{2}{3}$ ¢ a yard. What is the cost of the covering, if the desk-top is $1\frac{2}{3}$ yards by $\frac{2}{3}$ yard?

26. Find the weight of $15\frac{3}{4}$ feet of copper conductor weighing $2\frac{1}{4}$ pounds per foot.

27. Find the cost of 12 feet of the conductor, example 26, at $23\frac{1}{2}$ cents a pound.

Oral Exercise

Review pages 59–61.

283. 1. If $\frac{3}{4}$ pound of candy is divided equally among 4 children, what part of a pound does each child receive?

2. $1\frac{1}{2}$ pounds of coffee is divided equally to make 20 pots of coffee. How much is put into each pot?

3. How do you divide a fraction by a whole number?

NOTE. The pupil should notice that in dividing by a whole number, the process is the same as in multiplying by a fraction whose numerator is 1.

Divide:

4. $\frac{12}{15}$ by 4
5. $\frac{10}{11}$ by 5
6. $\frac{6}{8}$ by 7
7. $\frac{3}{7}$ by 5
8. $\frac{5}{9} \div 6$
9. $\frac{9}{20} \div 6$
10. $\frac{27}{30} \div 3$
11. $2\frac{2}{5} \div 4$

Written Exercise

284. Divide:

1. $12\frac{1}{2}$ by 7
2. $61\frac{3}{8}$ by 2
3. $46\frac{3}{4}$ by 11
4. $17\frac{1}{4}$ by 7
5. $14\frac{3}{8}$ by 5
6. $13\frac{5}{6}$ by 16
7. $21\frac{1}{7} \div 12$
8. $26\frac{11}{12} \div 14$

9. At Athabasca, in Canada, wheat has been raised weighing 60 lb. to the bushel; oats weighing $41\frac{3}{4}$ lb.; barley weighing $51\frac{3}{4}$ lb.; and spring rye weighing $57\frac{1}{2}$ lb. Find the weight of 1 bushel made up of $\frac{1}{4}$ of each of these cereals.

10. What is the average distance run in 1 hour by five express trains which made the following runs: $50\frac{1}{25}$ miles, $52\frac{1}{25}$ miles, $51\frac{2}{25}$ miles, $76\frac{1}{2}$ miles, and $63\frac{7}{25}$ miles.

11. *The World Almanac* records the trotting of three horses 1 mile in the following times: 2 min. $7\frac{3}{4}$ sec., 2 min. $15\frac{1}{4}$ sec., 2 min. $15\frac{1}{2}$ sec. What was the average time for the three?

Oral Exercise

Review pages 62 and 63.

285. 1. In a grain chest there are 6 bushels of oats. How many bags holding $\frac{3}{4}$ bushel each will the 6 bushels fill? How many holding $1\frac{1}{2}$ bushels will they fill?

2. How many railroad tickets can be bought for $\$12\frac{1}{2}$ if the tickets are $\$1\frac{1}{4}$ each?

3. How many bottles of ink at $\frac{8}{20}$ of a dollar each can be bought for $\frac{3}{4}$ dollar?

4. How do you divide by a fraction?

Divide:

5. $\$8$ by $\$\frac{2}{5}$
6. 9 da. by $\frac{3}{4}$ da.
7. 15 yr. by $1\frac{2}{3}$ yr.
8. 16 by $1\frac{1}{4}$
9. 14 by $2\frac{1}{2}$
10. 26 by $1\frac{6}{7}$
11. 6 by $4\frac{4}{5}$
12. $\frac{8}{20}$ by $\frac{2}{7}$
13. $16\frac{1}{2}$ by $3\frac{2}{3}$

Written Exercise

286. Divide:

1. $\frac{4}{5}$ by $\frac{4}{5}$
2. $\frac{5}{6}$ by $\frac{11}{10}$
3. $\frac{6}{7}$ by $\frac{6}{13}$
4. 42 by $3\frac{1}{3}$
5. 20 by $6\frac{2}{3}$
6. 100 by $87\frac{1}{2}$
7. 100 by $133\frac{1}{3}$
8. $16\frac{2}{3}$ by $\frac{2}{5}$
9. $1\frac{3}{4}$ by $\frac{7}{8}$
10. $3\frac{4}{5}$ by $\frac{7}{10}$
11. $6\frac{2}{3}$ by $1\frac{1}{12}$
12. $4\frac{6}{7}$ by $1\frac{3}{14}$
13. $25\frac{1}{3}$ by $\frac{3}{4}$
14. $56\frac{4}{5}$ by $\frac{5}{6}$
15. $7\frac{1}{2}$ by $\frac{5}{6}$
16. $8\frac{3}{4}$ by $\frac{7}{5}$
17. $10\frac{1}{2}$ by $1\frac{3}{4}$
18. $5\frac{2}{5}$ by $2\frac{1}{4}$
19. $3\frac{5}{6}$ by $11\frac{1}{2}$
20. $6\frac{6}{11}$ by $7\frac{1}{5}$
21. $7\frac{4}{5}$ by $8\frac{3}{3}$

22. A short ton is $\frac{25}{28}$ of a long ton. How many short tons are there in 800 long tons?

Written Exercise

287. 1. The perimeter of a square park measures $437\frac{2}{10}$ feet. What is the length of one side?

2. What is the cost of a granite curbing along one side of the above park at $\$1\frac{1}{2}$ a foot?

3. How many rods is it around the above park?

4. The distance around a square park is $26\frac{1}{2}$ rods. How many yards does it measure?

5. How many square feet does the park (example 4) contain?

6. How many square rods are there in the park?

7. What is the value of the land at $\frac{1}{2}$ dollar a square foot?

8. The material for a fountain in the center of this park cost \$350; the work of a mason in setting cost $\$57\frac{3}{4}$, of a plumber $\$18\frac{3}{8}$, of a painter $\$3\frac{1}{2}$. Find the total expense for the fountain.

9. 240 shrubs are bought at an average cost of $41\frac{2}{3}$ cents; they were set for $\$21\frac{1}{5}$. What was the amount of these two items?

10. In the grading and preparing of the park 4 men were employed $3\frac{1}{2}$ days at equal wages. For their labor they received $\$31\frac{1}{2}$. How much did each man receive? How much per day?

11. If the fountain is played 2 days a week for 4 hours each day during the 3 summer months, and discharges 56 gallons a minute, how much will it discharge during the summer?

12. If it requires an average of $2\frac{2}{5}$ days a week for 2 men to take care of the above park, how many days would it require for 1 man to do it?

Oral Exercise

Review pages 80, 81, 85, 87.

288. Read the following:

	a	*b*	*c*	*d*
1.	7.26	9.177	258.3	90.9138
2.	5.01	1.3914	258.03	0.420
3.	0.05	11.35	25.83	400.020
4.	0.54	0.66	25.803	5.555
5.	0.61	93.08	2.583	55.55
6.	3.7	600.066	2.5803	0.055
7.	.713	.666	3.15	2140.0001
8.	700.013	16.1308	31.50	.2141
9.	7.915	.105	.0711	.8191
10.	5.55	100.005	700.0011	8100.0091

Give the sums at sight:

11. $40.3 + 6.4$ 13. $0.505 + 0.101$ 15. $.125 + .375$

12. $21.05 + 1.50$ 14. $425.30 + 2.50$ 16. $62.5 + 37.5$

17. What is .3 of 100 cents? of 50 cents?

18. What is .4 of 30? What is .2 of 30?

19. From a flock of 50 hens .1 are sold. How many remain?

20. How many minutes are there in .5 of an hour? in .25 of an hour? in .50 of an hour? in .75 of an hour?

21. A man sells a quantity of fruit for \$5. If .6 of this is profit, what is the profit?

22. James earns \$1.60 a day. His sister earns .75 as much. How much does she earn? His father earns 1.25 as much as James. How much does his father earn?

Written Exercise

Review page 83.

289. How do you change a decimal to a common fraction?

Express as common fractions in their lowest terms:

	a	*b*	*c*	*d*	*e*	*f*
1.	.2	.20	.68	.456	.125	1.26
2.	.11	.13	.75	.350	.666	13.7
3.	.9	.68	.46	.333	.833	15.0
4.	.4	.50	.85	.205	.600	3.5

How do you change a common fraction to a decimal?

Express decimally:

	g	*h*	*i*	*j*	*k*	*l*
5.	$\frac{3}{4}$	$\frac{1}{8}$	$\frac{5}{8}$	$\frac{16}{25}$	$\frac{7}{16}$	$\frac{64}{125}$
6.	$\frac{2}{5}$	$\frac{3}{8}$	$\frac{4}{5}$	$\frac{9}{8}$	$\frac{18}{75}$	$\frac{9}{200}$

Express as decimal fractions to three places:

	m	*n*	*o*	*p*	*q*	*r*
7.	$\frac{3}{5}$	$\frac{18}{21}$	$\frac{11}{18}$	$\frac{13}{33}$	$\frac{12}{19}$	$\frac{54}{78}$
8.	$\frac{25}{66}$	$\frac{14}{37}$	$\frac{25}{26}$	$\frac{10}{11}$	$\frac{14}{9}$	$\frac{28}{12}$

Oral Exercise

290. Give answers to the following in decimals:

1. When 45 gallons of molasses sell for $27, what is the price per gallon?

2. The cost of 4 dozen eggs is $\frac{2}{3}$ of a dollar. What is the price per dozen?

3. There are 5 house lots made out of 3 acres of land. What part of an acre is 1 lot?

4. 100 dozen copy books cost $120. What is the cost per book?

Written Exercise

Review page 85

291. 1. Add 0.006, 3.467, 0.8, 10.24

2. Add 42.7, 65.83, 0.218, 7.09.

3. Add four hundred twenty and seventy-two thousandths, three hundred nine thousandths, six tenths, forty-four and nine hundredths.

4. To nine hundred and ninety-nine thousandths, add .999.

5. Find the sum of 7.62, 14.2, 120.5, 9.08, 0.875.

6. To eight thousand seven hundred sixteen ten-thousandths, add eight thousand and seven hundred sixteen ten-thousandths.

Add:

7.	8.	9.	10.	11.
7.34	6.136	100.	.0095	$2.333\frac{1}{3}$
83.015	18.742	1.01	1.0147	$.285\frac{5}{7}$
253.1	5.78	10.10	6.07	$1.222\frac{2}{3}$
6.646	.25	101.011	3.0912	$.833\frac{1}{3}$

12. A farmer has four pastures measuring in acres as follows: 11.625 acres, 7.875 acres, 12.333 acres, 14.8 acres. What is the total acreage of his pastures?

13. A foundry received 6 car loads of pig iron of the following weights: 23.75 tons, 27.85 tons, 24.6 tons, 25.29 tons, 24 tons, 30.4 tons. What was the total weight?

14. The following figures give the daily receipts in tons of second-class mail matter at a certain post office for a week: Monday, 2.5 tons; Tuesday, 1.75 tons; Wednesday, .85 ton; Thursday, 1.58 tons; Friday, 1.26 tons; Saturday, 2.45 tons. What was the total for the week?

Oral and Sight Exercise

Review page 85.

292. 1. Subtract at sight:

65	6.5	.65	.065	6.05	.1067
−15	−1.5	−.15	−.015	−1.05	−.0027

2. From 1.00 take .25; from 1. take .25.

3. From 400 take .5; from 4.00 take .5.

Written Exercise

293. 1. Subtract .0803 from 800.0056.

2. 44.581	3. \$3.75	4. \$1.66⅔	5. \$0.83⅓
−8.6375	−.375	−.87½	−.16⅔

Change fractions to 3 places of decimals and subtract in lines and in columns:

	8.	9.		12.	13.		16.	17.
6.	$8\frac{1}{3}$	$-.3\frac{1}{4}=$	10.	$6\frac{3}{4}$	$-1.4\frac{1}{2}=$	14.	$8.33\frac{1}{3}-$	$2\frac{5}{6}=$
7.	$4.4\frac{1}{12}$	$-1.2\frac{3}{8}=$	11.	$3.1\frac{5}{8}$	$-0.2\frac{3}{5}=$	15.	$5\frac{7}{8}$	$-.2\frac{4}{5}=$

18. A dealer charges for 5.16 tons of coke, but there is a shortage of .24 of a ton in the delivery. How much should he charge for?

19. A certain quantity of water weighed 52.125 pounds. After two days it had lost by evaporation 2.62 pounds in weight. What was the weight of the water remaining?

20. The average weight of a 12-year-old boy is 75.81 pounds; of a 12-year-old girl, it is 3.16 pounds less. What is the average weight of the girl?

Oral and Written Exercise

Review pages 87–90.

294. 1. How do you express the multiplication of a whole number by 10? by 100? by 1000? by .1? by .01? by .001?

2. How do you express the multiplication of a decimal by 10? by 100? by 1000? by .1? by .01? by .001?

3. 25 multiplied by 1 is how many times as much as 25 multiplied by .1?

4. The product of 600 multiplied by .2 is what part as much as the product of 600 multiplied by 2?

Supply the missing numbers:

5.	7.
0.5 multiplied by 10 = ——	12.5 multiplied by 10 = ——
5. multiplied by 10 = ——	.875 multiplied by 100 = ——
50. multiplied by 100 = ——	6.25 multiplied by 1000 = ——

6.	8.
50. multiplied by .1 = ——	3.24 multiplied by .1 = ——
5. multiplied by .01 = ——	27.27 multiplied by .01 = ——
.5 multiplied by .001 = ——	80. multiplied by .001 = ——

Find the products and their sums:

9.	10.
\$50.7 × 10 = ——	\$58. × .1 = ——
\$4.75 × 100 = ——	\$4.7 × .01 = ——
\$13.57 × 1000 = ——	\$83.2 × .001 = ——
\$0.375 × 10 = ——	\$18470. × .0001 = ——
Sum of products,	Sum of products,

11. Express each product in examples 9 and 10 as cents.

Written Exercise

295. Multiply the following:

1. 5101.3 by 10
2. .0001 by 60
3. .2001 by 83.7
4. 70.05 by 5.1
5. 28.003 by .03
6. 45.37 by 100
7. .0404 by 2.4
8. 188 by .0061
9. 75.955 by 200
10. .16⅔ by 400
11. 1.87½ by 800
12. 2.33⅓ by 600
13. 42.003 by 11.25
14. 6.583 by 54.1
15. 22.5 by 8400
16. 423.02 by 405
17. 19.65 by 36
18. .872 by 2500
19. 6.207 by 76
20. .003 by 3900
21. .738 by 4400
22. 600.24 by 26
23. 524.73 by 370
24. 8.64 by 40400
25. 44.9 by .08
26. 81.4 by .11
27. 11.8 by 1.1
28. 10.73 by 11.1
29. 90.09 by 11.11
30. $37.50 by .01
31. 645 by 1.01
32. 10.38 by 11.01
33. 1.84 by 101.01
34. 533.8 by .003
35. 51.21 by 1.003
36. 5.005 by .006
37. 1.661 by 1.002
38. 24.7 by .06
39. 78.3 by .6
40. 7.85 by .03
41. 613 by .06
42. 821.4 by .004
43. .764 by .003
44. 2.006 by .09
45. 468 by .0007
46. 3.92 by .005
47. 3.923 by .0005
48. .0429 by .57
49. .3614 by 5.67
50. 43.077 by .0003
51. 2.006 by 8.02
52. 3.6414 by 1.03
53. 20 by .565
54. 7.003 by .006
55. .0105 by 6.14
56. .532 by .081
57. 7.34 by 4.05
58. 4.06 by .505
59. 73.05 by 6.3
60. 2.033 by 4.11
61. 2.12 by .066
62. 30 by 1.77
63. 109 by .41
64. 77.07 by 12
65. 6.61 by 44
66. 62.5 by 16
67. 2.72 by 38.5
68. 100.1 by 25.6
69. 66.34 by 1.25
70. 251.06 by 25
71. 54.614 by 3.2
72. 1111.2 by 36.8
73. 348.3 by 68.11
74. 37 by 1.007
75. 99 by .51

Written Exercise

296. 1. Tell how you multiply decimals.

2. A freight train is made up of 20 cars. The average weight of a load for a car is 24.62 tons. What is the total weight of the freight for these 20 cars?

3. One box of oranges costs $5.50. At the same price, how much do 40 boxes cost?

4. If 1 franc piece, French money, is worth 19.3 cents in United States money, how much are 50 francs worth?

5. In a certain city the tax upon $1000 of property is: for the state, $1.19; for parks, highways, sewers, etc., $1.83; for the county, $1.05; and for the city, $12.33. What is the total tax upon $1000? upon $20,000?

6. A square measures 9.75 inches on a side. Find its perimeter.

7. A tank when full contains 296.08 gallons. How much does it contain when it is .57 full?

8. The circumference of a circle is nearly 3.1416 times the diameter. Using this number, find the circumference of a circle whose diameter is 9.8 inches.

9. How many square feet are there in a lot 97.89 feet long and 67.98 feet wide?

10. What is the perimeter of the above lot?

11. Reckoning the meter to be 1.0936 of a yard, how many yards must I buy for a dress pattern of 5 meters?

12. Find the cost of repairing a roof: painting 749 square feet at 2¢ a foot, 43 slates at 10¢ each, 14 pounds of zinc at 13¢ a pound, 9 pounds sheet lead at 11¢ a pound, 4 men, 2.5 hours, at 50¢ an hour each. Make a bill for this and receipt it.

Oral and Sight Exercise

Review pages 94, 95.

297. Tell how you divide decimals.

Divide at sight:

	a	*b*	*c*	*d*
1.	.8 by 2	7.14 by 2	35.7 by 7	25. by .5
2.	.24 by 4	12.3 by 3	9.6 by 12	15. by .15
3.	.15 by 15	60.5 by 5	20.4 by 10.2	6.66 by 2.22
4.	18.6 by 6.2	8.08 by 2.02	6.30 by 3.15	28.7 by 4.1

Written Exercise

298. Find the quotients and their sum:

1. 74.7 ÷ 10 =
   16.75 ÷ 10 =
   87. ÷ 100 =
   1324. ÷ 1000 = _____

2. 20.09 ÷ 100 =
   1800. ÷ 100 =
   175.5 ÷ 10 =
   60. ÷ 1000 =

3. There are 20 shillings in an English pound sterling. If one pound is equal to 4.8665 dollars of United States money, what is the value of one shilling?

4. What is the value of one half of an English pound sterling in United States money?

5. If a German mark is worth 23.8 cents in United States money, how many marks will there be in $1.19?

6. If 1 English gallon equals 1.2 gallons in United States measure, how many English gallons make 60 United States gallons?

7. The commercial value of gold is $20.6718 per ounce. What is the value of .1 of an ounce?

Written Exercise

299. Write in words:

1. 1,036,090
2. 3.6705
3. .315
4. 303.015
5. CLXVII
6. MDCCLXXVI

Change to common fractions in their lowest terms:

7. \$ .87½
8. \$1.25
9. \$.1875
10. \$.16⅔
11. .52
12. .625
13. .31¼
14. 1.50

15. Reduce to decimals and add: $\frac{3}{5}$, $\frac{7}{16}$, and $\frac{13}{25}$.

16. Find the sum of 8.96; .07; 7500.039; .896, and .9876.

17. Find the quotient of $\frac{16}{25} \div \frac{11}{15}$; of $21 \div \frac{5}{8}$.

18. What is the result of $2873.648 \div .021$?

19. From 17.15 take 1.5 of 6.558.

Find:

20. $\frac{4}{5}$ of 729 bushels
21. $\frac{3}{7}$ of 441 acres
22. The g. c. d. of 153, 204, 510
23. The l. c. m. of 15, 20, 50

24. A certain city has a population of 39,708; of this number $\frac{8}{13}$ are of foreign birth. How many are foreign? How many are natives?

25. Light travels 185,172 miles per second. How far is it from the sun to the earth, if it takes 8 minutes and 13 seconds for light to traverse the distance from the sun to the earth?

26. The moon is 238,800 miles from the earth. When the moon and the sun are on opposite sides of the earth, how long does it take the light to traverse the distance from the earth to the moon and back to the earth? (Answer to 3 decimal places.)

27. What is the difference in the cost of 76 tons of soft coal at \$3.75 per ton and 37.5 tons of hard coal at \$7 a ton?

Written Exercise

300. 1. If 1 bale of cotton weighs 450 lb., what number of bales can be made from 30,000 lb.?

2. How many fence posts and rails will be required for a fence 1740 feet long, if the posts are set 12 feet apart from center to center and the fence is 4 rails high and the rails are 12 feet long?

3. I wish to make a picture frame $3\frac{1}{2}$ ft. long, and $\frac{2}{3}$ as wide as it is long. Find the width of the frame. Find the entire length of the molding for the frame.

4. A cubic foot of granite weighs 170 lb. What is the weight of a block containing 6.4 cubic feet?

5. Find the cost of 56,000 bricks at \$8.50 per thousand.

6. The bill for storing a lot of goods is $\$11.66\frac{2}{3}$. If the price per year for storage is \$10, how many months were these goods stored?

7. A rectangular pasture contains 530 square rods. The width is 15.2 rods. What is the length of the pasture?

8. If it costs \$2.75 per 100 rods for a single wire to fence the lot, example 7, what will be the cost to fence the lot 4 strands high?

9. Of a street that is 55.5 feet wide, .4 is given up to 2 sidewalks. If they are of equal width, what is the width of each?

10. How many fence posts at \$.27 each can be bought for \$11.34?

11. A steel rail weighs 70 lb. per yard. What weight of rail is required to lay 30.25 feet?

Written Exercise

301. 1. How many cubic feet of air are there in a room 20 feet long, 15.6 feet wide, and 8.5 feet high?

2. When upland cotton is bought at \$.27⅜ and sold at \$.21⅞ a pound, how much is lost on 1333 bales of 460 lb. each?

3. At \$4.75 per hundred pounds, what is the cost of 8 barrels of sugar averaging 312 lb.?

4. What is the gain in buying 12 bushels of chestnuts at \$3.25 a bushel and selling them at 8¢ a pint?

5. What is the cost of a load of wood 12 feet long, 4 feet wide, and 4 feet high, at \$8.50 a cord?

6. What is the gain to a housekeeper who pays 25 cents a week from Jan. 1 to April 1, 1908, for having the coal cinders screened, if she thereby saves 1700 pounds of coal worth \$5 a ton?

7. Obed French has an account against Abel Powers with debits as follows: \$268.45; \$307.87; \$95.08; \$867.65; \$770.04; \$8.97; and credits as follows: \$56.65; \$675.90; \$507.66; \$300.75; \$86.88; \$865.56. State the balance due on this account, and to whom it is due.

8. The postage on a letter from England to Portland, Oregon, is 5 cents. This is about ½ of a cent for each 1000 miles. Find from this the approximate distance from England to Portland, Oregon.

9. Find the cost of 3¾ lb. sirloin at 28.4¢ a pound; of 1 lb. if ¾ lb. cost 18.6¢.

10. What is the cost of 1 hour's labor if 5.5 hours cost \$4.40?

11. A long ton is 1.12 of a short ton. How many long tons are there in 480 short tons?

Review pages 126–128.

Oral and Sight Exercise

302. 1. What do the words *per cent* and the sign % mean?

Express by fractions in their lowest terms the following per cents of a whole thing or number:

	a	*b*	*c*	*d*
2.	1 % of it	20 % of it	80 % of it	$16\frac{2}{3}$ % of it
3.	10 % of it	40 % of it	75 % of it	$8\frac{1}{3}$ % of it
4.	25 % of it	5 % of it	$37\frac{1}{2}$ % of it	$\frac{1}{3}$ % of it
5.	$12\frac{1}{2}$ % of it	$33\frac{1}{3}$ % of it	30 % of it	$66\frac{2}{3}$ % of it
6.	$\frac{1}{2}$ % of it	$1\frac{1}{3}$ % of it	$87\frac{1}{2}$ % of it	$83\frac{1}{3}$ % of it

303. Illustrative Example. Express 50 % in common fractions within hundredths:

Thus, 50 % = $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{6}$, $\frac{4}{8}$, $\frac{5}{10}$, $\frac{6}{12}$, $\frac{7}{14}$, $\frac{8}{16}$, $\frac{9}{18}$, $\frac{10}{20}$, and so on to $\frac{50}{100}$.

Express the following in common fractions within hundredths:

	e	*f*	*g*	*h*	*i*	*j*	*k*	*l*
7.	25 %	$16\frac{2}{3}$ %	5 %	20 %	$37\frac{1}{2}$ %	75 %	$66\frac{2}{3}$ %	$\frac{1}{4}$ %
8.	$33\frac{1}{3}$ %	10 %	$8\frac{1}{3}$ %	$12\frac{1}{2}$ %	$62\frac{1}{2}$ %	87 $\frac{1}{2}$ %	$82\frac{1}{3}$ %	$18\frac{3}{4}$ %

Read the following:

	m	*n*	*o*	*p*	*q*	*r*
9.	8 %	150 %	$\frac{1}{2}$ %	125 %	500 %	$\frac{2}{3}$ %
10.	$6\frac{1}{4}$ %	$94\frac{1}{3}$ %	75 %	.5 %	$18\frac{3}{4}$ %	1.1 %

11. What per cent of a number is $\frac{1}{100}$ of it? $\frac{1}{10}$? $\frac{1}{5}$? $\frac{1}{2}$? $\frac{1}{4}$? $\frac{3}{4}$? $\frac{2}{5}$? $\frac{3}{5}$? $\frac{3}{10}$? $\frac{7}{10}$? $\frac{1}{3}$? $\frac{3}{8}$? $\frac{5}{8}$? $\frac{7}{8}$? $\frac{1}{6}$? $\frac{5}{6}$? $\frac{1}{3}$? $\frac{2}{3}$?

Oral Exercise

304. 1. What is 1 % of 100? 2 % of 100? 10 % of 100? 10 % of 200? 12 % of 100? 12 % of 50? 12 % of 200?

2. What is 6 % of 100 cents? of \$1? of \$2? of \$5? of \$16? of \$13?

What fractional part of a number is represented:

	a	*b*	*c*	*d*	*e*
3.	By 1 %?	by 2 %?	by 6 %?	by 50 %?	by $12\frac{1}{2}$ %?
4.	By 10 %?	by 5 %?	by 90 %?	by 9 %?	by $62\frac{1}{2}$ %?
5.	By 70 %?	by 15 %?	by 12 %?	by 20 %?	by $87\frac{1}{2}$ %?

6. For every 100 bushels of grain that he raises, a tenant farmer pays his landlord 30 bushels. What per cent of his grain does he pay? If he raises 1000 bushels in all, how many bushels does he pay for rent?

7. In a test in arithmetic Eva answered 8 of the 10 questions correctly. What per cent of her answers were correct?

8. Clara spelled 49 out of 50 words correctly. What per cent were correct?

9. School keeps 5 days a week. What is the per cent of attendance of a pupil who is present all but $\frac{1}{2}$ day?

10. If I lend \$100 to a man and he pays me \$4 for the use of it, what per cent of the money does he pay?

11. If when he pays the \$4, he also pays the \$100 loaned, what per cent of the money loaned do I receive?

12. For a suit of clothes a man spends \$40; \$20 of the \$40 is for a coat; \$10 for trousers; \$8 for vests; \$2 for a hat. What per cent is paid for each item?

Oral and Sight Exercise

305. 1. Of each of the following numbers take 50 %; 25 %; 75 %:

24; 16; 40; 56; 96; 32; 72; 64; 88; 104; 120.

2. Of each of the above take $12\frac{1}{2}$ %; $37\frac{1}{2}$ %; $62\frac{1}{2}$ %.

3. Of each of the following take $16\frac{2}{3}$ %; $33\frac{1}{3}$ %; $66\frac{2}{3}$ %; 75 %:

12; 24; 30; 36; 48; 60; 72; 96; 18; 42; 54; 66; 120.

Give results at sight:

4.	10 % of 20	$83\frac{1}{3}$ % of \$30	1 % of \$15
5.	20 % of 10	$12\frac{1}{2}$ % of \$8.16	$\frac{1}{3}$ % of \$15
6.	$\frac{1}{2}$ % of 40	$37\frac{1}{2}$ % of \$1.60	$\frac{2}{3}$ % of \$15
7.	40 % of 20	$62\frac{1}{2}$ % of \$8.80	$\frac{4}{5}$ % of \$500
8.	$33\frac{1}{3}$ % of 75¢	$87\frac{1}{2}$ % of \$7.20	$1\frac{1}{3}$ % of \$30
9.	$66\frac{2}{3}$ % of 60¢	75 % of \$2	$3\frac{1}{2}$ % of \$1000

The pupils should dictate similar exercises to the class.

Written Exercise

306. Illustrative Example. Find 75 % of \$9000.

Work	Work	Explanation
(1) 90.00	(2) $75\% = \frac{3}{4}$	(1) 75 % = .75; .01 of \$9000 = \$90.00.
.75	2250	.75 = 75 × \$90.00 = \$6750.
450 00	$\frac{9000 \times 3}{4} = 6750.$	*Ans.* \$6750.
6300 0		
6750.00		

1. Tell how you find a per cent of a given number.

2. Find 90 % of \$250.
3. Find 25 % of \$9.60
4. 60 % of 175 bu.
5. 80 % of 60 lb.
6. 50 % of \$6.40
7. 1.4 % of 5.4 ft.

Written Exercise

307. Find:

1. 7 % of 180
2. 4 % of 647
3. 25 % of 124
4. $12\frac{1}{2}$ % of 456
5. 13 % of 361
6. 48 % of 854
7. 14 % of 720
8. 9 % of 384
9. 8 % of 190
10. $33\frac{1}{3}$ % of 660
11. $3\frac{1}{2}$ % of 64.7
12. 2 % of 92.5
13. 3 % of \$6.30
14. 5 % of \$5.40
15. 4 % of 55
16. .2 % of 864
17. $8\frac{1}{3}$ % of 1728
18. $6\frac{1}{4}$ % of \$960
19. 4 % of \$5.30
20. .3 % of 787
21. .7 % of 309
22. 8 % of \$950
23. $7\frac{1}{2}$ % of 678
24. 6 % of 705
25. 6 % of \$7.70
26. 9 % of \$5.66
27. $\frac{3}{4}$ % of \$16.80
28. 95 % of \$700
29. 103 % of \$70.50
30. 110 % of \$50
31. 125 % of \$7.20
32. $5\frac{1}{2}$ % of \$6.54
33. $3\frac{1}{4}$ % of \$5.38

34. Of a car load of 800 bunches of bananas, 50 % were sold to one fruit dealer, $12\frac{1}{2}$ % to another, and 35 % to another. How many bunches were sold? At \$2.35 a bunch, how much was received for them?

35. A lot of land containing 2 acres, valued at \$26 per square rod, is secured for a schoolhouse. If the owner deducts 40 % from its value, how much remains to be paid?

36. A piece of ground that yielded 60 bushels of onions last year, by fertilizing is now yielding 180 % as many. What is the yield this year?

37. By extra care a lot of hens that produced 180 dozen eggs in January increased their yield of eggs 6 % in February. What was the gain, eggs selling at 20¢ a dozen?

Written Exercise

308. A man has a yearly income of $1800. He pays 16⅔ % of it for rent, 20 % of it for groceries and provisions, and 10 % of it for clothes.

1. Find how much the man pays for each item of the above expenses.

2. Find what he pays for all, and what sum is left.

3. A merchant's profits for a year are $4800. He spends 62½ % of it for living expenses. How much are these? How much is left?

4. Mr. Jones inherits $14,000. He invests 70 % of it in securities which pay 4 % a year. How much does he invest? How much does it pay him in a year? What per cent of his money is left?

5. A real estate dealer had 450 acres of land to sell. He sold 16 % of it at $290 an acre. How much did he get for it? If he was paid 2 % of this sum for selling the land, how much was he paid?

6. A man paid $2100 for a horse which he afterward sold at a loss of 37½ %. What was the amount of his loss?

7. In 80 % of an acre of land there are how many square rods? How many square yards are there in the remainder of the land?

8. How many rods are there in 90 % of a mile? How many feet are there in the remainder of a mile?

9. Of a class of 48 pupils only 31¼ % were able to perform all the problems assigned them. How many failed?

10. 54 pupils spelled 30 words each. 9 words in all were spelled incorrectly. What per cent was this of all the words spelled?

Review pages 130, 131.

Oral and Sight Exercise

309. 1. If 3 % of a sum of money is $.75, what is 1 % of it? What is 100 % of it? 75 is 3 % of what number?

2. 6 is 50 % of what?

3. 8 is 4 % of what?

4. $6 is 6 % of what?

5. 42 is 7 % of what?

6. 42 is 6 % of what?

7. 40 is $12\frac{1}{2}$ % of what?

8. 15 is $2\frac{1}{2}$ % of what?

9. 10 is $62\frac{1}{2}$ % of what?

10. 12 is $16\frac{2}{3}$ % of what?

11. $36 is $16\frac{2}{3}$ % of what?

12. A man gives $2, which is 10 % of his week's wages, in charity. What are his week's wages?

13. In the study of arithmetic Frank spends 1 hour a day, which is 20 % of the school hours in a day. How many school hours are there in a day?

Written Exercise

310. 1. A trader sells a horse at a gain of $80 above its cost, which is 25 % of its cost. What is its cost?

2. A gain of 15 pupils increased a school 5 %. What number had it before the increase?

3. The present number of pupils in a school is 315. If this is an increase of 5 % upon its former number, what per cent of its former number is its present number? Find its former number.

4. A firm, failing, can pay but 35 % of their debts. If they can pay $6650, what is the amount of their debts?

Oral Exercise

311. 1. A merchant sells tea at 60¢ a pound, which is 150 % of the cost. Find the cost.

2. A dry goods dealer sells ginghams at 16¢ a yard, which affords him a profit of $33\frac{1}{3}$ %. How much did they cost him a yard?

3. After $66\frac{2}{3}$ % of a barrel of sugar had been sold, there remained 108 pounds. How much did the barrel originally contain?

4. After 5% of the oil in a tank had evaporated, there remained 57 gallons. How many gallons did it lose by evaporation?

5. 10 % of the metal in the gold coins of the United States is alloy. What is the current value of a gold coin that has $4.50 worth of pure gold?

6. After spending 80 % of his money, a boy had $2.60 left. How much had he at first?

7. A hennery lost by exposure 40 % of its fowls. If there still remained 120 fowls, how many had it at first?

8. The loss of 3 chickens in a brood reduced it to 75 % of its former number. What was its former number?

9. By sponging, a piece of woolen cloth shrunk 12 %. If it was then 11 yards long, what was its original length?

10. An increase of 100 % in a cotton crop gives 3000 bales. What was the former yield?

11. Eggs selling at 45¢ a dozen afford a profit of 50 % to the dealer. How much did they cost him?

Oral Exercise

312. 1. I buy a horse for $200 and sell it at a gain of 40%. What is my gain? For how much do I sell the horse?

2. If $20 paid on a debt is 10% of the whole debt, how much is the whole debt? How much of the debt remains to be paid?

3. What price must be put upon butter that costs 18 cents in order to make a profit of $16\frac{2}{3}$ per cent?

4. How much must an article that cost $10 be sold for to gain 30%? 60%? 40%? $37\frac{1}{2}$%?

5. A lot of silk sells for 125% of its first cost. If it sells for $1.00 a yard, what was its first cost?

Written Exercise

313. 1. By dieting, a man weighing 180 lb. reduced his weight 14% in 3 months. How much did he then weigh?

2. Of an estate of $30,000, 27% is in a savings bank that pays 2% at the end of 6 months. The balance is in railroad stocks that pay 4% every 6 months. What sum is paid by the bank? by the railroad? by both?

3. After spending 70% of his money, Mr. B had $48.75 left. How much had he at first?

4. A dealer buys hats at $14 a dozen. If he sells them at 150% of their cost, how much does he get for 1 hat? How much does he gain on a half dozen?

5. A distance of 280 miles is to be traveled in 8 hours. How many miles remain when 65% of the whole distance has been traveled? How many hours remain when 65% of the whole time has been spent?

Written Exercise

314. 1. A house was built at a cost of $3600. It was sold for 145 % of its cost. What was the selling price? What was the profit?

2. On an investment, Mr. Fox finds he has made 85 % in 5 years. If this is equal to $5950, how much was his investment?

3. A farm valued at $34.86 per acre in 1900 increased in value 17 % in 5 years. What was the value of the farm per acre at the end of 5 years?

4. A decrease of 290 in the number of cattle on a ranch is $12\frac{1}{2}$ % of the original stock. What was the original stock?

5. If the timber made from a lot of woodland sells for $954 and this is 90 % of the price paid for the land, how much was paid for the land?

6. Mr. Bean's hay crop is 230 tons this year, which is an increase of 15 % over the crop last year. What was last year's crop?

7. At the same rate of increase, what will Mr. Bean's hay crop be next year?

8. What will the whole crop, example 7, sell for at $12.80 per ton?

9. What is the real value of a $5 gold piece that has lost by wear $\frac{1}{8}$ of one per cent of its weight?

10. What is the real value of two $10 gold pieces that have lost by wear $1\frac{1}{4}$ % of their weight?

11. In a certain city election only 60 % of the legal voters voted. The number that did vote being 9360, what was the whole number of voters in the city?

Review page 132.

Oral Exercise

315. 1. A drover driving 200 pigs to market sold 10 by the way. What per cent of the drove did he sell?

2. If the 10 pigs he sold by the way brought $3 each and the market price of the rest was $2.50, what per cent did he gain on the 10, compared with the market price?

3. 20 of the passengers on an electric car rode but part way. If the whole number that rode was 60, what per cent rode but part way? What per cent rode the whole way?

4. Of a barrel of apples containing 2 bu. 3 pk., 2 pk. were spoiled by freezing. What per cent were spoiled?

5. By care in managing a range fire, 2 out of 16 tons of coal were saved. What per cent was saved?

6. A bank loaned $500 for 2 months, and received $5 for the loan. What per cent was received? At the same rate, what per cent would be received for a year?

7. A potato crop was harvested on shares. The harvester received 15 bushels out of 120 bushels harvested. What per cent did he receive?

8. If a man works 8 hours a day and sleeps 6 hours, what per cent of his time does he work? What per cent of it does he sleep? What per cent is left?

9. How many rods make a mile? What per cent of a mile is 40 rods? 20 rods? 10 rods?

10. How many yards make a rod? What per cent of a rod is $\frac{1}{2}$ yard? What per cent of a rod is $\frac{1}{2}$ foot?

Oral Exercise

316. Illustrative Example. (1) Find 7% of $300. (2) Find the number of which $21 is 7%. (3) Find what per cent $21 is of $300.

(1) $21, the number found by taking 7% of $300, is called the **percentage.**

(2) $300, the number of which 7 per cent is taken to find a percentage, is called the **base.**

(3) $\frac{7}{100}$, the number of hundredths which the percentage is of the base, is called the **rate per cent.**

317. The process of finding the percentage, the base, and the rate per cent may be formally stated thus:

(1) *To find the percentage, multiply the base by the rate.*

(2) *To find the base, divide the percentage by the rate.*

(3) *To find the rate, divide the percentage by the base.*

What is the percentage of the following?

1. Base $50, rate 6%.
2. Base $200, rate 5%.
3. Base $7.70, rate 110%.
4. Base 500 lb., rate 12%.
5. Base 240 miles, rate 2%.
6. Base 80 rods, rate $2\frac{1}{2}$%.

What is the base of the following?

7. Percentage $6, rate 6%.
8. Percentage $20, rate 4%.
9. Percentage $24, rate 8%.
10. Percentage 15 lb., rate 5%.
11. Percentage $7\frac{1}{2}$ hr., rate 3%.
12. Percentage 16 yd., rate 2%.

What is the rate of the following?

13. Base $500, percentage $25; $50; $40; $60.
14. Base $100, percentage $3.50; $9; $125; $200.
15. Base $200, percentage $12; $50; $25; $12.50.
16. Base $50, percentage $2.50; $5; $10; $75.
17. Base $650, percentage $13; $325; $65; $1300.
18. Base $54, percentage $2.70; $9; $18; $27.

Written Exercise

318. 1. The People's House Furnishing Company sells a library table, the marked price of which is $40. Mr. A. buys the table and, paying cash, is allowed a reduction of 10% from the marked price. How much is the reduction?

A reduction from the regular or marked price of goods is called a **discount.**

The price given in a catalogue, or list of prices, is called the **list price.** The price remaining after discounts are taken off is called the **net price.**

2. What is the net price of a $10 article that is sold at 20% discount? at 50% discount?

3. What is the discount on a piano if the list price is $600 and the discount 30%? What is the net price of the piano?

4. The list price of a lot of goods amounts to $400. They are bought at discounts of 25%, 10%, and 5%. What is the net sum paid?

NOTE. After the first discount of 25% is deducted, each remaining discount is reckoned in turn upon the net sum remaining, and not upon the original price.

5. Goods listed at $800 are sold at discounts of $\frac{1}{4}$ (25%), $\frac{1}{5}$ (20%), and 5%. Find the net price paid.

6. What is the net cost of a lot of plumbers' materials listed at $200 and sold at discounts of 40% and 10%?

7. Find the discount on 10 rugs sold at $40 each, $\frac{1}{8}$ off ($12\frac{1}{2}$% discount). How much is paid for them?

8. How much is paid for 8 clocks at $25 each, 20% off?

9. What is the net cost of 230 sweepers sold to a dealer at $1.80, at 25 % and 10 % discount?

Written Exercise

319. 1. What is the net price of cloth sold at 5% discount, which is listed at $1.20 a yard?

2. On a bill for $2500 worth of goods a merchant receives a discount of 15% for cash payment. How much does he pay?

3. A bill of $257.50 is discounted as follows: 20%, 10%, and 5% off for cash. What is the net amount paid?

NOTE. See Note, page 197, example 4.

4. A bill for a lot of books amounting to $523 is discounted as follows: 20%, 10%, and 5%. What is the net amount paid?

5. Find the net cost of 9 dozen hats at $18 a dozen less $6\frac{1}{4}\%$ discount.

6. A lot of steel amounting to $700 was bought at 50% and 20% discounts. What was the net cost?

7. A dealer marked $1600 worth of clothing at 40% above cost and then made a 20% discount on the asking price. What was his selling price? What was his net gain?

8. What is the net cost of books billed at $280, if 14% discount is allowed?

9. How much must I get for $150 worth of goods to gain 20% on the net cost if I buy them at $16\frac{2}{3}\%$ discount?

10. A dealer in paints bought, at 40% discount, 75 cans of paint listed at 50¢ per can. He got a further discount of 5% for making immediate payment. How much did he pay?

11. A bill of $240 for stationery was reduced by discount of 20%, 10%, and 5%. What was the net amount?

Oral Exercise

320. 1. A dealer in real estate sells a piece of property for its owner at $2000. For making the sale the dealer receives 5 % on the selling price. How much does he receive? How much does the owner get?

321. A person, firm, or company employed to buy or sell goods or transact business for another party is called an **agent.**

Agents are known by different names. For example:

(1) A **commission merchant** is an agent who buys or sells goods for others and usually has actual possession of the goods.

(2) An **auctioneer** who is licensed to offer goods for public sale by auction, that is, to the highest bidder, acts as an agent.

(3) A **broker** is an agent who arranges for the sale of goods and property, of which he may not at any time have possession.

A **stock broker** buys and sells stocks, bonds, etc.

A **real estate broker** buys and sells real estate.

(4) A **collector** is an agent employed to collect debts.

The amount paid to an agent for services is called a **commission** or **brokerage.**

The amount left after the commission or brokerage and other charges are paid, is called the **net proceeds.**

2. Find a book agent's commission, at 40 %, on the sale of a set of encyclopedias for $40. Find the net proceeds.

3. At 5 % commission, what is paid a teachers' agency for securing for a teacher a position paying a salary of $1000?

4. A traveling salesman receives a yearly salary of $2000 and a commission of 2 % on his sales. What is his total income if his sales amount to $ 70,000 in one year?

Written Exercise

322. 1. An agent in Australia purchased for the American Woolen Co. a quantity of wool for which he paid $48,000. What was his commission at $1\frac{1}{8}\%$? What amount did the American Woolen Co. send him to make the purchase and cover his commission?

2. A real estate agent purchased a tract of land for me at a price of $13,500. If his commission was $2\frac{1}{2}\%$, how much did he receive for his services? How much did the land cost me, including the commission?

3. A salesman traveling for a shoe manufacturing firm sells goods on an 18% commission. If he sells $26,500 worth of goods in a year, what does his commission amount to?

4. A broker sells 25,000 bushels of wheat at a brokerage of $\frac{1}{8}¢$ per bushel. What is his brokerage?

5. A real estate agent secures a commission of 4% per month for a year on the rent of a house for which the rental price is $45 per month. What is the amount of his commission for the entire year?

6. Find the commission due on the purchase of $3300 worth of flour, commission $3\frac{1}{3}\%$. What was the total amount due, including the commission?

7. At 9% commission on $4800 worth of wheat sold by an agent, find what the net proceeds of the sale were.

8. What is the commission on the sale of 186 bbl. of flour at $5 per barrel, commission $3\frac{1}{2}\%$? What are the net proceeds of the sale?

9. 5 sets of encyclopedias are sold for $39.60 each. The commission received is $66. Find the rate %.

Written Exercise

323. 1. This record of an auction sale of fruit and produce is to be copied and filled out in each column.

Salesman No. 5.

Date, Sept. 5, 1907.

SMITH, BLODGETT & CO.,
Wholesale Commission Merchants.

NAMES	ARTICLES	AMT.	PRICE	AMT. SALES	2½% COM'N	CHARGES	NET PRO.
H. S. Elliot & Co.	Peaches	200 baskets	$ .90			$ 16.00	
Mr. E. Dix & Co.	Berries	30 crates	3.20			4.00	
F. B. Stone	Potatoes	610 bu.	.55			18.10	
W. B. Home & Co.	Tomatoes	65 bu.	1.40			2.50	
S. S. Goodwin	Lemons	56 boxes	3.55			7.62	
B. McAuley & Son	Bananas	104 bunches	1.84			4.20	
T. Fisher & Co.	Oranges	72 boxes	4.12			13.75	

2. On the purchase of a piece of statuary, a collector received a commission of 12 %. The purchase price was $ 25,000. What was the amount of the commission?

3. What is the commission on the sale of 1400 M (thousand) of shingles at $ 3 per M, commission 1½ %? What are the net proceeds of the sale?

4. My agent sells goods for $ 8240 and charges 3 % commission. If he returns to me $ 7982.80 as the net proceeds of the sale, are his figures correct or incorrect? If there is an error in his account, what is it?

5. A profit of 100 % on a lot of goods sold for $ 8560 shows the cost to have been how much? What was the commission at ¼ % on the sale?

324. On August 1, 1907, Mr. Edwin P. Hall, of Haverhill, Mass., received the following tax notice :

City of Haverhill.

MR. EDWIN P. HALL,
Residence, 61 Columbia Park.
Ward 6, Precinct 3.

Your city, county, and state tax for 1907, is $102.00.

On real estate	$2500.00	$50.00
On personal property	2500.00	50.00
On poll		2.00

Please bring this bill at payment,
Rate of taxation, $20 per $1000.

Payment of the tax is hereby demanded. Payable at the Collector's Office, City Hall.

If not paid before Jan. 1, 1908, a summons will be issued, for which charges will be made.

An error in the name of the person taxed does not defeat the collection of the tax. Prompt payment will save costs. Any failure to receive tax bill does not invalidate a tax or proceedings for collection of the same.

ARTHUR T. JONES,
Collector of Taxes.

HAVERHILL, Aug. 1, 1907.

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325. Money collected by the city, town, state, or national government to pay the expenses of government is a **tax**.

Taxes are laid on persons, on property (through its owner), and on business.

326. A tax on a person is called a **poll tax.**

Look up the word *poll* in the dictionary.

327. A tax on property is called a **property tax.**

Property taxes are levied upon real estate, as lands and buildings, and on personal property, as cattle, horses, carriages, furniture, stocks, and money.

Property taxes are usually a certain per cent of the estimated value of real estate and personal property.

A poll tax is a tax varying from $1 to $3 paid by each male citizen over 21 years of age.

328. In order that a fair estimate may be placed upon all property, officials are chosen, whose duty it is to estimate, or **assess,** the value of all property subject to taxation. These officials are called **assessors.**

329. A special official for collecting the taxes is called a **collector.**

330. The per cent of taxation is called the **tax rate** or **rate of taxation.**

The rate of taxation may be expressed as a number of mills on each dollar, a number of cents on each hundred dollars, or a number of dollars on each thousand dollars, of the assessed value of property.

A tax rate of 20 mills means 20 mills on each dollar, and is therefore 2%, or $20 on each $1000.

Oral Exercise

331. 1. Mr. Smith, of Hanover, is taxed on $1000 worth of real estate. How much is his tax at a rate of 1%? of 2%?

2. Find the tax on property assessed at $2000, if the tax rate is 10 mills on each dollar; if it is 3 mills; 30 mills.

3. At the rate of 15 mills on a dollar, what is the tax on $1000? $6000? $7500? $1300? $1200? $600? $500?

4. Find the tax on $1500 at 4 mills rate; on $1800 at 10 mills rate; on $10,000 at 8 mills rate.

Written Exercise

332. Illustrative Example. If Mr. Moseley's real estate is assessed for $4500, his personal property for $1600, and the tax is 14 mills, what is the total amount of his tax, including a $2 poll tax?

Work

$4500 + $1600 = $6100
$6100 × .014 = $85.40
$85.40 + $2 = $87.40 total tax

Explanation. $4500 + $1600 = $6100, the total amount of property taxed.

The rate is 14 mills, or .014. $6100 multiplied by .014 = $85.40, the property tax. Adding $2, the poll tax, gives $87.40, the total tax.

1. Find the amount of L. G. Brest's tax bill, who owns a house valued at $5400 and personal property valued at $1265, and who pays a $2 poll tax, the rate being 15 mills on $1?

2. What is the amount of L. Good's tax bill, who owns a farm and buildings assessed at $11,750, horses, cattle, tools, farm products, and other personal property assessed at $7650, the rate being 20 mills, and who pays a poll tax of $2?

3. What is the amount of E. J. Wild's tax bill, who lives in another town, but owns in the above, where rate is 15 mills on $1, 265 acres of woodland valued at $25 per acre?

4. If the tax rate in Lynn was $18 on $1000, what was the tax on Mr. Porter's property, if it was assessed at $14,500?

5. Mr. Jewett has property assessed at $7750. Find his total tax, the rate being $18.40 on $1000, and he paying one poll tax of $2.

6. The tax rate in Brookline was $10.50. What was Mr. Cooper's tax on property assessed for $19,000?

7. The assessed value of all property, real and personal, in a town is $4,500,000. The rate of taxation is $12.50 on $1000. What is the total property tax raised?

333. After spending a summer in Europe, Mrs. Church returns to America. Among other things, she brings home $125 worth of fine laces. At New York when the steamship enters the harbor, a government officer called a custom officer, or inspector, comes on board and examines all merchandise that has been brought over on the vessel. On the $125 worth of laces, Mrs. Church is required to pay a tax of 60% of their value, amounting to $75, before she is permitted to remove them from the custody of the officer.

This tax is called a **duty** or **custom.**

A large part of the income for the support of the national government is derived from duties or customs upon certain kinds of merchandise imported into the country.

The rates of duties are fixed by an act of Congress. The value of imported goods is determined by custom officers.

The duty is paid by the importer at a custom house.

334. Duties are reckoned (1) at a certain per cent of the cost of goods, called **ad valorem duties**, or (2) at a certain amount per pound, yard, etc., called **specific duties.**

Some merchandise is subject to both ad valorem and specific duties, as, for example, blankets at 22¢ per lb., specific duty, and also at 30% ad valorem.

The rates of duty on different kinds of merchandise are stated in the Specific Act of Congress, known as the Tariff Act.

Tariff means a list of charges.

Oral Exercise

335. 1. What is the duty on $1000 worth of clocks at 40%?

2. What is the duty on $100 worth of silks at 50%?

3. What is the duty on 200 cubic feet of rough marble at 50¢ per cubic foot?

Written Exercise

336. 1. What is the ad valorem duty at 35% on satin valued at $1500?

2. A grocer imports 75 bags of cocoa, each containing 140 lb. What is the duty at $2\frac{1}{2}$¢ a pound?

3. At 35% ad valorem, what is the duty on 1 hundred dozen of leather caps costing 136 francs a dozen? A franc is equal to $.193.

4. What is the specific duty at 40¢ a dozen on 85 dozen linen collars?

5. If velvet cloaks cost 750 francs each in Paris, what is the ad valorem duty at 50% on 6 cloaks?

6. Find the duty at 2¢ a pound on 495 boxes of figs, each box containing 147 lb.

7. The duty on plate glass is 35¢ a square foot. What is the duty on a plate measuring $8\frac{1}{2}$ ft. by $3\frac{1}{2}$ ft.?

8. What is the duty on 9 casks of molasses, 63 gallons each, at 3¢ a gallon?

9. Find the duty on 25 bales of peanuts containing 75 lb. each at $\frac{1}{2}$¢ a lb.

10. At 44¢ a square yard and 40% ad valorem, find the duty on 869 square yards of Brussels carpet valued at $1.45 per yard.

11. The duty on lace is 60%. Find the duty on lace worth $875.

12. If $3.75 is paid in duties on 2 dozen photographs valued at $15, imported from London, what is the ad valorem rate?

337. Mr. Ashley owns a business block in Springfield, valued at $30,000. In order to protect himself against possible loss in case of fire, he obtains an **insurance policy** from the Midland Fire Insurance Company, by which the company agrees to make good to him any loss, up to $20,000, that may arise within a certain specified time from damage or destruction of the block by fire.

Mr. Ashley's insurance contract is for three years, and for it he pays to the Midland Company a sum of money equal to $1\frac{1}{2}\%$ of the amount for which his property is insured; that is, $1\frac{1}{2}\%$ of $20,000, or $300.00.

338. Security against loss of any kind is called **insurance.**

Security against loss of property by fire is called **fire insurance**; against loss of ships and cargoes at sea by storm or fire, **marine insurance**; against loss of time, health, and labor by accident, **accident insurance**; against loss of time, health, money, etc., because of sickness, **health insurance**; against loss of life by either accident or sickness, **life insurance.**

339. The written contract of insurance between the company and the insured is called a **policy.** The policy defines the property insured and states the terms of the insurance.

340. The sum paid by the insurer to secure the contract is called a **premium.**

The premium is reckoned as a **per cent** of the amount insured.

Property is usually insured for somewhat less than its full value.

Insurance business is generally conducted by companies made up of persons who agree jointly to secure against loss.

341. The insurer is called the **underwriter,** because the officials of the insurance company write their names under the contract, or **policy.**

Oral Exercise

342. 1. What is the cost of insuring a house for \$5000 at 1% premium?

2. A vessel with cargo worth \$75,000 is insured for $\frac{2}{3}$ of its value at 3% premium. What is the premium?

3. A man's life is insured for \$6000 at an annual cost of \$18 on \$1000. What premium does he pay each year?

4. A pays a premium of 2% annually on goods worth \$18,000, insured for $\frac{2}{3}$ of their value. What is his premium?

5. Mr. Sheldon insures his house for \$3000 for a term of three years, paying $1\frac{1}{2}$% premium for the three years. What is the premium paid?

6. If Mr. Sheldon's house is injured by fire to the extent of \$1000, one year before the expiration of the term of insurance, the insurance company pays him \$1000 and continues the policy for the remainder of the 3 years. What is the net loss to the insurance company in the entire transaction if the rate of interest is 6% on the \$1000?

Written Exercise

343. Illustrative Example. A summer cottage is insured for $\frac{2}{3}$ of its value at a premium of 3% for 3 years. Its value is \$2200. What is the premium paid?

WORK

$\frac{2}{3}$ of \$2200 $= \frac{\$4400}{3} = \$1466\frac{2}{3}$

3% of $\$1466\frac{2}{3} =$

$\$1466\frac{2}{3} \times .03 = \$44$

or

$$\frac{\$22\cancel{00} \times 2 \times \cancel{3}}{\cancel{3} \times 1\cancel{00}} = \$44.$$

EXPLANATION. The value is \$2200. $\frac{2}{3}$ of the value is $\frac{1}{3}$ of \$2200 = \$1466$\frac{2}{3}$. 3% of $\$1466\frac{2}{3} = \$44$, which is the premium paid.

Or, expressing the entire work and canceling, we have \$44.

Ans. \$44.

Written Exercise

344. 1. What must be paid for a policy of $2500 on the books and furniture in a house, the rate being $\frac{3}{8}$ %?

2. My house, valued in the policy at $4000, is insured for 5 years at a premium of 2 %. What is the premium, and what does my insurance cost me per year?

3. A hotel is insured for $90,000 at $2\frac{1}{8}$ % for 3 years. What is the cost of insurance per year?

4. A stock of goods valued at $193,239 is insured for $\frac{2}{3}$ of its value at $1\frac{1}{4}$ %. What is the premium?

5. What premium is paid for insurance on a lot of silks on board steamer, invoiced at $25,000 and insured for $\frac{2}{3}$ the invoiced value at $\frac{3}{4}$ %?

6. A shipowner owns 50 ships, which may be supposed to be all of equal value. Which would be the more expensive for him, to pay 2 % a year for insurance on all his ships, or to lose a ship every two years?

7. A lot of lumber, which cost $30,000, is insured for $20,000 at $5\frac{1}{2}$ %. If it should be totally consumed by fire, what would be the net loss to the owner? to the underwriters?

8. What is the average rate of insurance paid by the owner of a schooner who obtains one policy for $5000 at $1\frac{3}{4}$ %, another for $7500 at $1\frac{1}{8}$ %, another for $4500 at $1\frac{7}{8}$ %, and another for $3000 at $2\frac{1}{8}$ %, all for one year?

9. A man secures a life insurance policy for $5000, paying at the rate of $29 per thousand annually. How much will he have paid the insurance company at the end of 10 years? If he were to die then, what would be the company's net loss?

Oral Exercise

Review page 132.

345. 1. A woman having $30 spent $15. She spent what part of the $30? what per cent?

2. Of 24 pairs of shoes, 8 pairs are sold. What part of the 24 pairs are sold? What per cent?

3. A man spent 10% of $50. How many hundredths of $50 did he spend? How much did he spend?

4. A merchant bought 1 dozen hats and sold 9. What part of the dozen did he sell? What per cent?

What per cent:

5. Of 100 is 40?
6. Of 40 is 20?
7. Of 200 is 60?
8. Of 32 is 8?
9. Of 1 lb. is 8 oz.?
10. Of 1 lb. is 12 oz.?
11. Of $1 is 60¢? 40¢?
12. Of 40 A. is 5 A.?
13. Of 1 rd. is $\frac{1}{2}$ yd.?

14. From a 30-yard piece of carpeting 18 yards were sold. What part was sold? What per cent? What per cent remained?

Written Exercise

346. 1. From 600 cords of wood 75 cords were sold. What part was sold? What per cent? What part and what per cent remained?

NOTE. 75 cords is $\frac{75}{600}$ of 600 cords. $\frac{75}{600} = \frac{25}{200} = \frac{12\frac{1}{2}}{100} = 12\frac{1}{2}\%$.

2. Mr. C. had in the bank $1400. He withdrew $350. What per cent did he withdraw? What per cent remained?

3. Out of 175 pairs of socks 125 pairs were sold. What per cent was sold? What per cent was left?

4. Of a school of 640 pupils 80 graduate. What per cent graduate? What per cent remain?

Written Exercise

347. 1. I sold a carriage that cost $160 for $180. How much did I gain? The gain was what per cent of the cost? The cost, $160, was what per cent of the selling price?

2. After selling 400 bushels of the wheat which he raised, a farmer had 2200 bushels left. What part of what he raised did he sell? What per cent did he sell? What per cent had he left?

3. I bought a farm for $2500 and sold it for $3500. What per cent did I gain?

4. Property that was worth $1600 was sold at auction for $1400. What was the loss? The loss was what per cent of the value?

5. A real estate agent sold a manufacturing plant for $65,000 and charged $2600 as his commission. What was his rate of commission? What were the net proceeds of the sale?

6. A bill for goods amounting to $650 is discounted for cash. If the payment is $617.50, what is the rate of discount?

7. At what rate of premium is a house insured if on $3200 insurance a premium of $40 is paid?

8. Mr. Lee's tax bill is $456. If his property is assessed for $24,000, what is the tax rate? How many mills on a dollar? How many dollars on a thousand?

9. On a school building costing $84,000, an architect received a commission of $4200 for drawing plans and supervising the construction. What was his rate of commission?

10. When boots costing $30 per dozen pairs sell at $3.50 a pair, what is the per cent of profit?

11. Find what rate per cent will give a percentage of $10, the base being $500.

Written Exercise

348. 1. The total duty at New York on 15 gallons of cologne, valued at $8 per gallon, was $90.00. If the specific duty was $2.00 per gallon, what was the rate of ad valorem duty per gallon?

2. If the town of G has a total valuation of taxable property amounting to $2,000,000, and must raise by taxation $50,000, what will be the tax rate? How many mills is this per dollar? How many dollars is it on a thousand?

3. An insurance company takes a risk of $90,000, and receives as premium $2250. What is the rate of premium?

4. A salesman receives a yearly salary of $1500 and 2 per cent commission on all sales. At the end of the year he receives in all $2,096.00. What is the value of the goods sold?

5. If a dry goods dealer sells gloves that cost $10 a dozen at 90¢ a pair, does he gain or lose? What is the per cent of gain or loss?

6. The silk sales of a department store amounted in three months to $23,500. The stock expense of the silk department in the same time was $15,400. What was the profit, and what was the per cent of profit on the cost?

7. A hardware dealer pays $36.00 for 10 dozen boxwood 2-foot rules. He sells them out at 50¢ apiece. What is the entire profit made? What per cent is made?

8. When boards that cost $40 per thousand feet sell at $6\frac{1}{4}$¢ a foot, what per cent is gained?

9. If a percentage is $40 and the base $200, what is the rate?

Written Exercise

349. 1. If a furnace costing \$240 is sold for \$320, how many dollars are gained? What per cent is gained?

2. 4.2 is what part of 42? 4.2 is what per cent of 42?

3. From $2\frac{1}{2}$ acres of land 40 square rods are sold. What per cent of the whole is sold? (160 sq. rd. = 1 acre.)

4. If eggs cost the grocer 40¢ per dozen, what per cent does he make by selling them at 48¢ per dozen?

5. If eggs cost the grocer $12\frac{1}{2}$¢ a dozen, what per cent does he gain by selling 5 dozen for \$1? What per cent does he gain by selling 6 dozen for \$1?

6. A merchant made a profit in one year of \$10,200 on a capital of \$35,000. What per cent of profit did he make?

7. It costs me \$145 a year for a \$5000 life insurance policy. What is the rate per \$1000? How much would a policy for \$10,500 cost me each year at the same rate?

8. My tax is \$43 on property assessed for \$4200. What is the rate of taxation?

9. I pay for gas at the rate of \$1.15 per thousand feet. If my bills for a year amounted to \$37.00, how many thousand feet did I consume?

10. What per cent of 18.4 is .4? of \$1.84 is \$.40?

11. An agent receives \$840, which includes a sum he is to expend for oranges, and his commission of 5% on the sum. Find his commission. With the rest of the money, how many oranges can he buy at \$2 per box?

12. The tax rate in a town is \$1.75 on \$100. Find Mr. Horn's tax on property assessed at \$13,800.

Oral Exercise

Review page 127.

350. Express the following per cents as common fractions:

	a	*b*	*c*	*d*	*e*
1.	20 %	50 %	$83\frac{1}{3}$ %	25 %	$8\frac{1}{3}$ %
2.	$12\frac{1}{2}$ %	$37\frac{1}{2}$ %	60 %	$16\frac{2}{3}$ %	$62\frac{1}{2}$ %
3.	$33\frac{1}{3}$ %	$87\frac{1}{2}$ %	$14\frac{2}{7}$ %	$66\frac{2}{3}$ %	110 %

4. If $\frac{1}{2}$ of a number is 60, what is the number?

5. If 50 % of a number is 40, what is the number?

6. If $33\frac{1}{3}$ % of a number is 40, what is the number?

7. $\frac{1}{5}$ of a number is 90. What is the number?

8. 20 % of a number is 10. What is the number?

9. \$400 is $\frac{4}{5}$ of how many dollars?

10. \$400 is 80 % of how many dollars?

11. 180 pounds is 90 % of how many pounds?

12. 35 tons is $\frac{7}{8}$ of how many tons?

13. 14 tons is $87\frac{1}{2}$ % of how many tons?

14. 144 inches is 60 % of how many inches?

15. 70 % of my money is \$21. What is the whole amount of my money?

16. If I spend 60 % of my month's earnings, I shall have \$32 left. How much money do I earn?

17. John is 12 years old, which is $\frac{8}{10}$ of the age of his mother, and 30 % of the age of his father. What is the age of his mother? of his father?

Written Exercise

351. 1. If 15 % of my money is $450, what sum have I?

2. 900 yards is 200 % of how many yards?

3. 120 % of a number is 600. What is the number?

4. If 150 % of a number is 900, what is the number?

5. 500 % of a number is how many times the number?

6. If 500 % of a number is 75, what is the number?

7. After increasing my money 25 %, I had $250. How much had I at first?

8. I lost 30 % of a stock of goods. The loss amounted to $1200. What was the value of the original stock?

9. If I add 75 % to the land I now have, I shall have 525 acres. How many acres have I now?

10. 200 % of a man's money is $300. What is $1\frac{1}{2}$ % of it?

11. A has $12,500, which is 50 % as much as B has. How much have A and B together?

12. What is the per cent of profit on 100 boxes of oranges costing $2.40 a box, and selling for the gross sum of $330?

13. The owner of a California orange orchard containing 12 acres reported a gross income of $4026, with expenses as follows: labor, $428.00; water, $165.15; fertilizers, $136.00; taxes, $68.70; picking and hauling, $236.15. What was the net income? What was the per cent of profit on a valuation of $1000 per acre for the land?

14. If 36 boxes of seedless grape fruit, selling at $6.50 per box, yielded a profit of 30 %, what was the cost of the lot?

Written Exercise

352. 1. A grocer by selling melons at 48¢ each makes a gain of 20%. How much does he pay for them?

2. A profit of 19¢ per ream on paper is 12% of the cost. What is the cost?

3. A $1\frac{1}{8}\%$ commission on a wool sale was paid to my agent, amounting to $90. What was the amount of the sale?

4. After selling 35% of a lot of wood, 104 cords were left. How many cords were there at first?

5. The selling price of goods marked $12\frac{1}{2}\%$ below cost was $700. What was their cost?

6. The present population of a city is 48,000, which is 25% more than the population 10 years ago. What was the population 10 years ago?

7. Mr. Hazen sold a span of horses for $560, at a profit of 40%. What was their cost to him?

8. An agent sold flour at 4% commission and charged $10. What was the amount of the sale?

9. If I pay $90 as a commission for selling wool at $12\frac{1}{2}\%$ commission, what is the amount of the sale?

10. My agent bought for me a lot of flour at $4 per barrel with money I sent him, which included also his commission of 4% on the purchase. If the money sent him was $520, how much was his commission? How many barrels did he buy?

11. What is the base, when a rate of 108% gives a percentage of $1404?

12. Find the percentage on $187.50, the rate being $1.33\frac{1}{3}\%$.

Written Exercise

353. 1. On sales an agent draws \$93.75 as his commission at $6\frac{1}{4}\%$. What is the amount of sales?

2. A grocer made a loss of \$9.60 on 24 bbl. of flour. If this was 5% of the cost, what was the cost per barrel?

3. A farm is sold for \$2700, which is $12\frac{1}{2}\%$ above cost. What was the cost?

4. After a discount of $14\frac{2}{7}\%$, the net cost of a lot of books was \$252. What was the list price?

5. If the net cost of a lot of hardware was \$200 after a discount of $16\frac{2}{3}\%$, what was the list price?

6. \$96 is the tax on how much property at \$19.20 on a thousand dollars?

7. When the tax rate is \$18.40, how much property will be taxed \$360.64?

8. Mr. H. paid \$75 for insuring some buildings for $\frac{3}{4}$ of their value at $1\frac{1}{2}\%$. What was the value of the buildings?

9. If a premium is \$91, and the rate $\frac{7}{9}\%$, what is the amount of insurance?

10. A percentage is \$450, the rate 3%. What is the base?

11. A percentage is \$7.50, the rate 150%. What is the base?

12. When \$575 is received for a horse, which is sold for 15% more than the first cost, what was the first cost?

13. My Boston agent advises me that he has bought for me 2000 lb. of leather, inclosing a bill for \$630, which includes the cost and his commission of 5%. Find his commission. Find the price per pound of the leather.

Written Exercise

354. 1. A invests \$10,000, and makes a yearly profit of \$4000. B invests \$6000, and makes a yearly profit of \$3000. What per cent of profit is made by A? by B?

2. At the same rate of profit, if B's investment was \$10,000, what would his yearly profit be?

3. Mr. Archer failed in business. He owed \$6400 and had property valued at \$4000. What per cent of his indebtedness could he pay?

4. A merchant's monthly profits were \$675 at $12\frac{1}{2}\%$. What was the cost of goods sold? For how much were they sold?

5. An acre of land was sold for \$475, which was 25% above cost. Find the cost.

6. A cotton broker charged a commission of $11\frac{1}{9}\%$ for buying a lot of cotton. His brokerage amounted to \$270. How much did the cotton and commission together cost? Both together were what per cent of the cost of the cotton?

7. An agent collected $62\frac{1}{2}\%$ of a debt of \$1600, and charged 8% commission for collecting. Find the net proceeds.

8. Goods costing \$680 are marked at 160% of the cost. $12\frac{1}{2}\%$ discount on the marked price is given for cash. What is the amount of profit? What is the per cent of profit?

Supply the missing percentage, base, or rate in the following:

9.	Base \$1728,	rate .5%,	percentage ——.
10.	Base ——,	rate 12.5%,	percentage \$6.25.
11.	Base \$100,	rate ——,	percentage \$.375.

Written Exercise

355. 1. A dishonest dealer was detected giving his customers only 14 oz. for a pound. What was the loss per cent to customers?

2. A house worth $5200 rents for $360 a year. Repairs, taxes, etc., cost $96 per year. What rate per cent does the house pay on the value?

3. Gloves at $1.25 per pair are selling at 25% profit. If they should be marked down 10% from this selling price, what per cent of profit would then be made on them?

4. A's age is $\frac{2}{3}$ of B's, and the sum of their ages is 60 years. What is the age of each?

NOTE. A's age is $\frac{2}{3}$ of B's; then, B's age being $\frac{3}{3}$ of itself, the sum, 60 years, must be $\frac{5}{3}$ of B's age.

5. Isaac's wages are 80% of his father's. The wages of both together are $36 a week. What are the wages of each a week?

6. A's money is $66\frac{2}{3}$% of B's; both have $119.60. What sum has each?

7. What sum yielding $3\frac{1}{2}$% will give an income of $2100 yearly?

8. Mr. Burns invested $32,000 at $3\frac{1}{2}$% annually. What was his annual income?

9. A house was sold for $4940, which was 30% above cost. What was the cost?

10. 144 rods is what per cent of one mile?

11. At a tax rate of $16.50 on $1000, what is the tax on a property assessed for $4400?

12. If the waste in cutting is 10%, how many feet of boards must I buy to cover 13,500 square feet?

Written Exercise

356. 1. I bought a lot of iron listed at \$780, at 50 % off the list price, and sold it at 20 % off the list price. How much did I gain? What per cent did I gain?

2. A manufacturer pays 60 % of his monthly expenses for labor. The remaining expenses amount to \$7500 per month. What is his total expense per month?

3. A builder bought 17,500 feet of boards. Allowing 10 % for waste and cutting, find the number of square feet they will cover.

4. After a 15 % raise in wages, a weekly pay roll amounted to \$8400. How much was the total increase made in wages?

5. A, B, and C engage in business. A puts in \$1400; B, \$1800; C, \$8000. What per cent of the whole does each put in? They gain \$12,000. What is each one's share of the profit?

6. At 25 %, what is the duty on 24 pieces of silk containing 48 yards each, at 90 cents a yard?

7. The list price of a lot of photographs is \$1200. If the discount is $16\frac{2}{3}$ % and 8 %, what is the net price? What must be the selling price to gain 20 % ?

8. If the tax rate of a town is \$14.50, what is the tax on property assessed for \$7800?

What must be the marked price of a book to allow 20 % discount, when cost and desired profit are as follows:

9. Cost \$1.00, profit 40 %.
10. Cost \$.80, profit 50 %.
11. Cost \$1.20, profit $33\frac{1}{3}$ %.
12. Cost \$.64, profit 25 %.
13. Cost \$4.80, profit $12\frac{1}{2}$ %.
14. Cost \$2.00, profit 20 %.

Oral Exercise

357. What per cent:

1. Of 1 ft. is 1 in.?
2. Of 1 yd. is 1 ft.?
3. Of 2 yd. is 1 ft.?
4. Of 120 is 20?
5. Of 200 is 25?
6. Of 70 is 35?

7. Find 25% of 1 bushel; of 1 peck; of 1 gallon; of 1 pound; of 4 pounds.

8. What is 10% of \$1.00? of \$6.00? of \$15.00? of \$200?

9. What is $12\frac{1}{2}$% of 1 pk.? of 1 bu.? of 1 lb.? of 2000 lb.?

10. What is $33\frac{1}{3}$% of 1 yd.? of 6 yd.? of 1 da.? of 1 min.?

11. Find $66\frac{2}{3}$% of 2 yd.; of 1 yd.; of 1 sq. yd.; of 1 cu. yd.

Tell of what number:

12. 50 is $33\frac{1}{3}$%
13. $33\frac{1}{3}$ is 50%
14. 40 is 20%
15. 40 is $83\frac{1}{3}$%
16. 80 is $66\frac{2}{3}$%
17. $66\frac{2}{3}$ is 80%

18. What part of 2 yd. is 1 ft.? 2 ft.? 4 ft.? 5 ft.?

19. What part of 60 days are 6 days? 10 days? 20 days?

20. What part of 200 mo. are 2 mo.? 40 mo.? 4 yr. 2 mo.?

21. What part of 200 mo. are 1 yr. 8 mo.? 2 yr. 1 mo.?

22. What part of 360 days are 180 da.? 90 da.? 36 da.?

23. What part of 6% is 3%? of $7\frac{1}{2}$% is $2\frac{1}{2}$%? 5%?

24. Mr. A.'s tax is \$200. If it is not paid when due, he is required to pay a percentage upon it at the rate of 6% for a year. What will the percentage be for 1 year?

25. What will the percentage be on the above, example 24, for 6 months? for 2 months? for 3 months? for 4 months?

26. What will the percentage be on the above for 1 month? for 15 days ($\frac{1}{2}$ mo.)? for 10 days? for 6 days?

27. What will the percentage be if payment on the above is deferred 2 years? What will both tax and percentage be?

Oral Exercise

358. 1. Walter Dudley hires a canoe at 20¢ an hour. How much must he pay for its use for 3 hours?

2. Mr. James Vale pays $100 per month rent for a factory. The building is valued at $24,000. What rent does he pay a year? What per cent is this on the value?

3. After paying rent for several years, Mr. Vale decides to secure a loan from the bank of $24,000, with which to buy the factory. The bank agrees to loan the $24,000 upon condition that Mr. Vale will pay to the bank each year a sum equal to 4% of the $24,000. How much must Mr. Vale pay each year?

359. Money paid for the use of money is called **interest.**

360. The sum for which interest is paid is called the **principal.**

4. $800 is loaned for a year at 4% interest. At the end of the year the principal, $800, and the interest are paid. How much is paid in all?

361. The sum of the principal and interest is called the **amount.**

362. The per cent of the principal paid each year is called the **rate of interest.**

The time is understood to be 1 year unless otherwise stated.

What is the interest for 1 year on:

5. $200 at 4%?
6. $300 at 5%?
7. $100 at $3\frac{1}{2}$%?
8. $450 at 2%?
9. $60 at 5%?
10. $600 at 7%?
11. $900 at $3\frac{1}{3}$%?
12. $250 at 8%?
13. $400 at $4\frac{1}{2}$%?
14. $800 at $5\frac{1}{2}$%?

At 3% what is the interest on:

15. $500 for 1 yr.?
16. $500 for 2 yr.?
17. $1000 for 3 yr.?
18. $2000 for 8 yr.?
19. $60 for 5 yr.?
20. $40 for 4 yr.?

Written Exercise

363. Illustrative Example. Find the interest on $32.50 for 2 years at 6 %.

Work	Explanation. The interest on $32.50 for 1 yr. at 6 % is .06 of $32.50, or $1.95. For 2 years the interest is 2 times $1.95, or $3.90. *Ans.* $3.90.
$32.50, principal	
.06, rate of int.	
$1.9500, int. for 1 yr.	
2	
$3.90 int. for 2 yr.	

To find the interest, we multiply the principal by the rate for 1 *year and this product by the number expressing the time in years.*

Find the interest on :

1. $440 for 2 yr. at 5 %
2. $875 for 3 yr. at 4 %
3. $12.40 for $3\frac{1}{3}$ yr. at 6 %
4. $47.50 for 2 yr. at $6\frac{1}{4}$ %
5. $1260 for $2\frac{1}{2}$ yr. at 4 %
6. $2400 for $2\frac{1}{3}$ yr. at 3 %
7. $87.50 for $1\frac{1}{4}$ yr. at 4 %
8. $156.80 for 5 yr. at 5 %
9. $320 for $4\frac{1}{2}$ yr. at 8 %
10. $4790 for $1\frac{3}{8}$ yr. at 6 %
11. $125.50 for 4 yr. at $2\frac{1}{2}$ %
12. $125.50 for $2\frac{1}{2}$ yr. at 4 %
13. $20.80 for 8 yr. at 6 %
14. $100 for $16\frac{2}{3}$ yr. at 6 %

Oral Exercise

364. 1. What part of a year are 6 months? 4 months? 8 months? 8 months? 9 months? 2 months? 10 months?

2. What is the interest at 6 % on $400 for 1 yr.? for 6 mo.? for 8 mo.? for 8 mo.? for 2 mo.? for 10 mo.? for 9 mo.?

3. What is the interest at 4 % on $300 for 7 mo.? for 11 mo.? for 5 mo.? for 9 mo.? for 10 mo.?

Written Exercise

365. 1. What is the interest on \$100 at 6 % for 1 year? for 6 months? for 4 months? for 3 months?

2. What is the interest on \$600 at 5 % for 1 year? for 6 months? for 9 months? for 2 months? for 10 months?

Find the interest for 6 months on:

3. \$200 at 8 %
4. \$100 at 4 %
5. \$1000 at $5\frac{1}{2}$ %
6. \$600 at 6 %
7. \$300 at 3 %
8. \$800 at $4\frac{1}{2}$ %
9. \$400 at 6 %
10. \$500 at 5 %
11. \$700 at $3\frac{1}{2}$ %
12. \$900 at 2 %
13. \$1200 at 10 %
14. \$1500 at 1 %

Find the interest for 4 months on:

15. \$300 at 3 %
16. \$800 at 6 %
17. \$400 at $4\frac{1}{2}$ %
18. \$200 at 5 %
19. \$500 at 3 %
20. \$600 at $7\frac{1}{2}$ %
21. \$900 at 3 %
22. \$1000 at 6 %
23. \$90 at $3\frac{1}{3}$ %

Find the interest for 2 months on:

24. \$400 at 6 %
25. \$300 at 6 %
26. \$220 at 2 %
27. \$610 at 4 %
28. \$500 at 6 %
29. \$700 at 6 %
30. \$230 at 3 %
31. \$90 at 1 %
32. \$100 at 9 %

Find the interest for 3 months on:

33. \$200 at 7 %
34. \$750 at 4 %
35. \$600 at 6 %
36. \$500 at 8 %
37. \$812 at 5 %
38. \$240 at 3 %
39. \$90 at 2 %
40. \$36 at 12 %
41. \$120 at 7 %
42. \$96 at 5 %
43. \$110 at 2 %
44. \$56 at 1 %
45. \$4200 at 3 %
46. \$5040 at 2 %
47. \$3100 at 8 %
48. \$8000 at 7 %
49. \$1000 at 12 %
50. \$1200 at 10 %

Written Exercise

366. Illustrative Example. Find the interest and amount of \$640 at 8% for 4 yr. 6 mo.

Work (1st form)		Work (2d form)	
4 yr. 6 mo. $= 4\frac{1}{2}$ yr.		\$640,	principal
\$640,	principal	.08,	rate of int.
.08,	rate of int.	51.20,	int. for 1 yr.
51.20,	int. for 1 yr.	204.80,	int. for 4 yr.
$4\frac{1}{2}$		2)51.20 = 25.60,	int. for 6 mo.
25.60,	int. for $\frac{1}{2}$ yr.	\$230.40,	int. for 4 yr. 6 mo.
204.80,	int. for 4 yr.	640,	principal
\$230.40,	int. for 4 yr. 6 mo.	\$870.40,	amt. for 4 yr. 6 mo.
640,	principal	*Ans.*	Int. \$230.40.
\$870.40,	amt. for 4 yr. 6 mo.		Amt. \$870.40.

Find the interest and the amount of:

1. \$16 for 2 yr. 3 mo. at 6%
2. \$200 for 1 yr. 6 mo. at 3%
3. \$600 for 3 yr. 3 mo. at 4%
4. \$500 for 6 yr. 8 mo. at 3%
5. \$2400 for 8 yr. 4 mo. at 6%
6. \$50 for 2 yr. 6 mo. at 5%
7. \$280 for 1 yr. 8 mo. at 6%
8. \$100 for 8 yr. 3 mo. at 2%
9. \$120 for 1 yr. 6 mo. at 8%
10. \$800 for 4 yr. 6 mo. at 2%
11. \$700 for 2 yr. 4 mo. at 6%
12. \$1200 for 3 yr. 8 mo. at 3%
13. \$900 for 1 yr. 3 mo. at 4%
14. \$1100 for 2 yr. 6 mo. at 8%
15. \$1000 for 1 yr. 6 mo. at 5%
16. \$500 for 2 yr. 1 mo. at 12%
17. \$604.80 for 1 yr. 10 mo. at 5%
18. \$840.60 for 5 yr. 6 mo. at 7%
19. \$96.30 for 2 yr. 3 mo. at $4\frac{1}{2}$%
20. \$639.90 for 2 yr. 9 mo. at 8%
21. \$62.82 for 2 yr. 3 mo. at 12%
22. \$543.60 for 2 yr. 11 mo. at 6%
23. \$46.80 for 4 yr. 6 mo. at $2\frac{1}{2}$%
24. \$926.10 for 3 yr. 8 mo. at $3\frac{1}{2}$%

367. In computing interest 30 days are considered a month and 360 days are considered a year.

Oral Exercise

368. 1. Considering 360 days a year, what part of a year are 10 days? 36 days? 12 days? 30 days? 6 days?

2. Considering 30 days a month, what part of a year are 60 days? 90 days? 120 days? 180 days?

3. At 1% what is the interest on $360 for 1 year? for 1 day? for 4 days? for 40 days? for 150 days?

4. At 6% what is the interest of $200 for 1 yr.? for 180 da.? for 90 da.? for 45 da.? for 30 da.? for 15 da.?

5. At 10% what is the interest on $300 for 1 yr.? for 180 da.? for 60 da.? for 120 da.? for 36 da.?

Written Exercise

369. Illustrative Example. Find the interest on $180 at 5% for 3 mo. 18 da.

WORK

$$\frac{\$\cancel{180} \times \cancel{5} \times \cancel{108}}{\cancel{100} \times \cancel{360}_{\cancel{20}\ 10}} = \frac{27}{10} = \$2.70$$

EXPLANATION. 3 mo. 18 da. = 108 da. = $\frac{108}{360}$ yr. The interest on $180 for 1 year at 5% is $\frac{5}{100}$ of $180. The interest for $\frac{108}{360}$ yr. is $\frac{108}{360}$ of $\frac{5}{100}$ of $180, $= \frac{\$180 \times 5 \times 108}{100 \times 360}$, which canceled = $2.70. *Ans.* $2.70.

Find the interest on:

1. $90 at 8% for 9 mo. 21 da.
2. $150 at 4% for 3 mo. 24 da.
3. $80 at 3% for 5 mo. 9 da.
4. $84 for 10 mo. 12 da. at 5%
5. $500 for 3 mo. 1 da. at 7%
6. $270 for 4 mo. 15 da. at 6%

Written Exercise

370. Illustrative Example. Find the interest and amount of \$90.72 for 2 yr. 4 mo. 24 da. at 5 %.

WORK

4 mo. 24 da. $= \frac{144}{360} = \frac{2}{5}$ yr.

\$90.72
.05
4.5360, int. for 1 yr.
$2\frac{2}{5}$
9.0720, int. for 2 yr.
1.8144, int. for $\frac{2}{5}$ yr.
10.89, int. for 2 yr. 4 mo. 24 da.
90.72, principal
\$101.61, amt. for 2 yr. 4 mo. 24 da.

EXPLANATION. The interest on \$90.72, for 1 yr. at 5% = \$4.5360. 4 mo. + 24 days = 144 days = $\frac{144}{360} = \frac{2}{5}$ yr. Then, the interest on \$90.72 for $2\frac{2}{5}$ yr. = $2\frac{2}{5}$ times \$4.356 = \$10.89, and the amount for $2\frac{2}{5}$ yr. = \$90.72 + \$10.89 = \$101.61.

Ans. { Int. \$10.89. Amt. \$101.61.

The 2d form, Art. 36, page 225, can be used, if preferred.

Find the interest and the amount of:

1. \$1000 for 3 yr. 4 mo. 18 da. at 6 %.
2. \$915.10 for 5 yr. 9 mo. 10 da. at $3\frac{1}{2}$ %.
3. \$600 for 6 yr. 1 mo. 14 da. at 5 %.
4. \$126.50 for 2 yr. 3 mo. 24 da. at 4 %.
5. \$560 for 1 yr. 6 mo. 12 da. at 4 %.
6. \$1200 for 5 yr. 3 mo. 15 da. at $4\frac{1}{2}$ %.
7. \$400 for 2 yr. 6 mo. 10 da. at 5 %.
8. \$685 for 4 yr. 7 mo. 16 da. at 4 %.
9. \$1575.50 for 3 yr. 2 mo. 9 da. at 3 %.
10. \$875.25 for 4 yr. 8 mo. 11 da. at 2 %.

Written Exercise

371. Find the interest and amount of the following:

	Principal	Time	Rate
1.	\$ 250.00 for	6 mo. 15 da. at	4 %.
2.	\$ 280.20 for	2 yr. 4 mo. 12 da. at	5 %.
3.	\$2180 for	6 mo. 18 da. at	$4\frac{1}{2}$ %.
4.	\$ 445.00 for	45 da. at	5 %.
5.	\$ 264.80 for	120 da. at	6 %.
6.	\$1326.50 for	1 yr. 3 mo. 20 da. at	5 %.

7. Find the interest for each quarter of a year on a loan of \$5.50, which was borrowed at $5\frac{1}{2}$ % per annum.

8. Mr. S. sends the quarterly premium on his life insurance policy 20 days after it is due. If he pays 6 % interest for the overdue time (20 days), how much money must he send to cover the premium and interest, if the quarterly premium is \$36.40?

9. Mr. F. buys a wagon for \$85. He pays \$40 cash and agrees to pay the balance in 4 months with interest at $4\frac{1}{2}$ %. At the end of 4 months how much is due?

10. The savings of the boys of the B school for the first quarter of the year were \$372.50. This sum was deposited, April 10, in a savings bank that allows interest at the rate of $4\frac{1}{2}$ % and adds it to the principal semiannually. Find the new principal Oct. 10 of the same year; April 10 of the next year.

11. In addition to a tax on \$15,000 at the rate of \$13.50 on \$1000, an extra charge was made for 27 days' delay of payment at the rate of 6 %. Find the total sum to be paid.

Written Exercise

372. Illustrative Example. Find the interest on $400 at 3% from Jan. 1, 1907, to April 16, 1907.

Work	Explanation. To find the time, we subtract the earlier from the later date.
1907---4---16	Calling January the 1st month and April the 4th month, we find the time is 3 mo. 15 da., $= \frac{1}{4}\frac{5}{8}$ yr.
1907---1--- 1	
3---15	

$$\frac{\overset{4}{\cancel{\$400}} \times \cancel{3} \times \overset{7}{\cancel{105}}}{\underset{\cancel{360}}{\cancel{100}} \times \underset{2}{\cancel{360}}} = \$3.50$$

The interest on $400 at 3% is $\frac{3}{100}$ of $400, $= \$12$.

The interest for $\frac{1}{4}\frac{5}{8}$ yr. is $\frac{1}{4}\frac{5}{8}$ of $\frac{3}{100}$ of $400, $= \$3\frac{1}{2} = \$3.50$. *Ans.* $3.50.

Find the interest on:

1. $1200 from Jan. 21 to April 27, at 6%.
2. $360 from June 15 to Oct. 30, at 6%.
3. $950 from April 1 to June 13, at 6%.
4. $684 from Sept. 20 to Nov. 29, at 6%.
5. $360 from Jan. 1, 1907, to May 19, 1908, at 6%.
6. $120 from Aug. 3, 1908, to Oct. 6, 1908, at 6%.
7. $4800 from Oct. 4, 1907, to Oct. 19, 1908, at 3%.
8. $3100 from Feb. 1, 1907, to Feb. 25, 1908, at 4%.
9. $600 from Sept. 4, 1906, to Jan. 24, 1908, at 12%.
10. $200 from Dec. 5, 1907, to Jan. 5, 1910, at $4\frac{1}{2}$%.
11. $3000 from March 25, 1908, to Dec. 15, 1908, at 7%.
12. $100 from Nov. 28, 1908, to Feb. 4, 1910, at 6%.
13. $12 from March 18, 1900, to July 12, 1902, at 6%.
14. $40 from Dec. 28, 1907, to May 10, 1909, at 3%.
15. $587.50 from May 29, 1908, to July 5, 1909, at 6%.
16. $540 from Oct. 5, 1907, to April 17, 1909, at 4%.

373. A flat surface is called a **plane.**

374. A plane figure bounded by a line every point of which is equally distant from a point within called the **center** is called a **circle.**

375. The bounding line of a circle is called the **circumference.**

376. Any straight line connecting opposite points in the circumference and passing through the center of a circle is called the **diameter.**

377. Any straight line extending from the center to the circumference of a circle is called the **radius.**

The circumference of a circle is about how many times its diameter? Measure and see.

Written Exercise

378. 1. Considering the circumference of a circle to be $3\frac{1}{7}$ times its diameter, find the circumference of a circle whose diameter is 7 inches; 4 inches; 10 inches; 12 inches.

2. Find the diameter of a circle whose circumference is 11 inches; 22 inches; 33 inches; $5\frac{1}{2}$ inches.

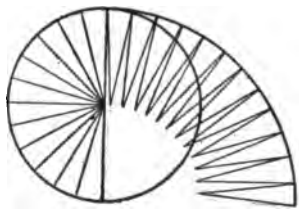
Find the circumference of a circle whose:

3. Diameter is $3\frac{1}{2}$ inches.
4. Diameter is $2\frac{1}{3}$ inches.
5. Diameter is $1\frac{3}{4}$ inches.
6. Diameter is 7 inches.
7. Diameter is $1\frac{2}{5}$ feet.
8. Diameter is $1\frac{1}{6}$ feet.
9. Diameter is 14 inches.
10. Diameter is $4\frac{2}{3}$ inches.

11. Find the length of the tire to a wheel which measures $1\frac{1}{2}$ feet from center to circumference.

12. A circular pond is 120 feet around. What is its greatest width?

379. A circle may be considered to be made up of triangles the sum of whose bases is the circumference, and whose height is the radius. Hence,



To find the area of a circle, we multiply the circumference by $\frac{1}{2}$ the radius.

Written Exercise

380. Find the circumference and area of a circle whose :

1. Radius is 2 ft.
2. Radius is 4 ft.
3. Radius is 1 ft.
4. Radius is 3 ft.
5. Radius is $2\frac{1}{2}$ ft.
6. Radius is $3\frac{1}{2}$ in.

7. How many square feet are covered by the base of a round tower 105 feet in diameter?

8. A circular grass plot whose diameter is 42 ft. requires how many feet of fence to inclose it?

9. How many square feet and square inches are there in a round table top 56 inches in diameter?

10. A circular lawn has a diameter of 84 feet. How many square feet does it contain? The land cost 78 cents a foot and the fence around it 90 cents a foot. Find the entire cost.

11. What will be the area of a walk 7 feet wide to surround this lawn? How much will it cost at 90 cents a square yard?

12. A circular pond is inclosed by a curbing which consists of 176 stones, each 2 ft. 6 in. long. Find the diameter of the pond. (Art. 378.) Find the radius; the area.

13. In the middle of this pond is a circular basin 21 feet in diameter, which contains a fountain. How much space is occupied by the basin? by the pond outside the basin?

381. Wholesale price list of cabinetmakers' screw-drivers.

Size		No. 40	No. 45	Size		No. 40	No. 45
$2\frac{1}{2}$ in.	each	$0.25	$0.25	$9\frac{1}{2}$ in.	each	$0.75	$0.75
$3\frac{1}{2}$ in.	each	.30	.30	$10\frac{1}{2}$ in.	each	.84	.84
$4\frac{1}{2}$ in.	each	.36	.36	$12\frac{1}{2}$ in.	each	1.00	1.00
$5\frac{1}{2}$ in.	each	.42	.42	$15\frac{1}{2}$ in.	each	1.25	1.25
$6\frac{1}{2}$ in.	each	.50	.50	$18\frac{1}{2}$ in.	each	1.50	1.50
$7\frac{1}{2}$ in.	each	.59	.59	$21\frac{1}{2}$ in.	each	2.00	2.00
$8\frac{1}{2}$ in.	each	.67	.67	$24\frac{1}{2}$ in.	each	2.50	2.50

Written Exercise

382. Discounts from the above prices in dozen lots or over are allowed as follows: 40% and 10% from list prices for No. 40 and 40% net for No. 45.

1. At the discounts given above, find the cost of the following bill of goods:

2 doz. $2\frac{1}{2}$ in. No. 40	4 doz. $9\frac{1}{2}$ in. No. 40
$1\frac{1}{2}$ doz. $4\frac{1}{2}$ in. No. 45	1 doz. $12\frac{1}{2}$ in. No. 40
3 doz. $7\frac{1}{2}$ in. No. 40	1 doz. $21\frac{1}{2}$ in. No. 45

2. At the above prices, for how much would a $12\frac{1}{2}$ in. screw-driver be sold to make 30% profit?

3. At the price charged the retail dealer, if he sells a $9\frac{1}{2}$ in. screw-driver for 75 cents, how much does he gain on it? What is his per cent of profit?

4. The goods listed above (example 1) were sold to Mr. Edwin Vance Apr. 15, 19—. He paid $25 in cash at the date of purchase. Make up in proper form Mr. Vance's account with the items of debit and credit and the balance due.

Oral Exercise

383. 1. If one cubic foot of cedar weighs 50 lb., how much will weigh 600 lb.?

2. A tenpenny nail is 3 inches long. How much does it fall short of going completely through a 4.5 inch timber?

3. It takes 88 common eightpenny nails ($2\frac{1}{2}$ in. long) to weigh a pound. How many would weigh $\frac{1}{2}$ lb.? $\frac{1}{4}$ lb.? 2 lb.?

4. It takes 5 lb. of fourpenny nails to lay 1000 shingles. I wish to lay 3500 shingles and have on hand only 9 lb. of nails. How many more must I buy?

5. It takes 30 lb. of eightpenny nails to lay 1000 ft. of flooring. How many pounds will lay a floor 10 ft. by 20 ft.?

6. It takes 400 roofing slates, 9 by 12 inches, to lay 100 square feet. A roof having two sides, each containing 600 square feet, will take how many slates?

7. It takes 900 shingles laid 4 inches to the weather to cover 100 square feet. How many will cover a shed roof 15 by 20 feet? How much will they cost at $3.00 per thousand?

8. If there are 8000 two-ounce tacks in a pound, how many tacks are there in an ounce?

9. What is the weight of 2 cubic feet of cast iron if 1 cubic foot weighs 450 lb.?

10. A tank measuring 693 cubic inches contains 3 gallons. Find the number of cubic inches in a gallon.

11. $12\frac{1}{2}\%$ of 2 is what part of 1?

12. If a box 4 feet long 3 feet wide contains 96 cubic feet, how deep is it?

Written Exercise

384. 1. How many cubic inches are there in $7\frac{1}{2}$ gal.? About how many gallons are there in 1 cu. ft.?

2. Reckoning $7\frac{1}{2}$ gal. to a cubic foot, how many gallons will be contained in a copper tank 2 ft. by 2 ft. by $1\frac{1}{2}$ ft.?

3. A British imperial gallon is .2 larger than the United States standard gallon. How many cubic inches does it contain?

4. There are 33.6 cu. in. in a pint dry measure. How many cubic inches are there in a bushel?

5. How many ounces are there in 1 ton (2000 lb.)? How many ounces are there in a long ton, which exceeds the short ton by 240 lb.?

6. How many bricks will be required to line with one layer the walls of a cellar 30 feet square, 7 feet deep, each brick to cover 8 in. by 2 in., no allowance being made for cement or corners?

7. What would be the gain per ton on coal bought at $7 a ton by the long ton, 2240 lb., and sold at the same price by the short ton?

8. Mr. Allen owes $150 on a note dated Jan. 1, 1907. He agrees to pay 4% interest for the whole or any part remaining unpaid till the full sum is paid.

July 1, 1907, he pays $50 with the interest then due; Jan. 1, 1908, he pays $100 with interest then due. Find the amount paid July 1, 1907; the amount paid Jan. 1, 1908.

9. What is due for the storage of a lot of furniture at $1.50 a month from Jan. 1, 1907, to Jan. 28, 1908?

Written Exercise

385. 1. There is an approximate decrease of temperature of 1 degree for every 300 feet of ascent. If in ascending a mountain there has been a decrease of 11 degrees from the base to the top, what is the approximate height of the mountain?

2. To make 5 shelves 18 inches by 18 inches each, how much in length of a board 9 inches wide is required?

3. How many square feet of board will there be in the stock for the above shelves? How much will it cost for oak stock at 10¢ a board foot?

NOTE. Board measure is reckoned in board feet. A board foot is 12 in. × 12 in., and 1 in., or less, in thickness.

4. An ocean line steamship made a record of 601 nautical miles in 24 hours. What was the average per hour?

5. A share of railroad stock that cost $160 pays its owner each year 8% on its original value, which was $100. What per cent does it pay on its cost?

6. A desk-top is 30 inches square, and the ruler upon it contains 30 square inches. What is the difference of their areas?

7. Find the interest on $120 for 4 mo. and 18 da. at 6%.

8. Find the interest on $600 for 16 mo. 20 da. at 3%.

9. A bank loans Mr. A. money upon his note for $600 to be paid in 6 mo., at the rate of 6% a year. If the bank deducts the interest at the beginning of the 6 months, how much will Mr. A. receive?

10. When completed, the canal from Panama to Colon will have a length of about 50 miles. The cost is estimated at $250,000,000. Find the average cost per mile.

Written Exercise

386. 1. On the railways of Great Britain the freight rate is approximately $2.30 per ton for each 100 miles. In the United States the rate is only 30 % as great. What is the rate in the United States?

2. In building a railway the railroad officials hired of a bank $350,000 for 4 months. If the bank deducted interest at 4 %, what sum did the railroad officials receive?

3. If the fare between two points is $2.05, and the distance is $102\frac{1}{2}$ miles, what is the rate per mile?

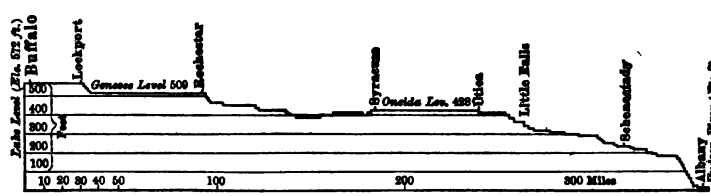
4. A share of stock in an electric railway bought at $90 was sold 6 months later for $62.50. What was the loss per cent?

5. What would have been the total gain if the money paid for the above share of stock had drawn interest for the same time at the rate of 4 % a year?

6. The railways of the world have a total length of about 536,000 miles. Of these the United States has 40 %. How many miles has the United States?

7. If the freight on a barrel of flour from Chicago to New York is 70 ¢, how much will it cost to carry 2500 lb.?

8. The length of the Erie Canal is 387 miles. From the Lake level to the Hudson River, what is the average fall per mile? per hundred miles? Make other problems.



PROFILE OF ERIE CANAL

HORIZONTAL SCALE 100 MILES TO THE INCH, VERTICAL SCALE 1,000 FEET TO THE INCH

Written Exercise

387. **1.** Find the total cost for equipping a manual training room at the prices given below:

20 benches,	each @	$8.50	20 stools,	each @	$1.00
20 hammers,	each @	.35	1 miter box,	@	12.00
20 backsaws,	each @	.90	1 broadaxe,	@	1.50
20 rules,	each @	.15	sandpaper,	@	1.00
20 screw-drivers,	each @	.40	10 wood files, coarse	each @	1.00
20 marking gauges,	each @	.15	10 wood files, fine	each @	1.80
20 6-in. try squares,	each @	.30	1 pair pliers,	@	1.10
20 compasses,	each @	.50	20 jack planes,	each @	1.20
4 oil stones,	each @	.60	20 block planes,	each @	.60
6 rip saws,	each @	1.00	5 jointer planes,	each @	2.00
6 bit stocks,	each @	1.20	1 large steel square,	@	1.25
6 sets bits,	each @	6.00	2 bevels,	each @	.40
6 sets chisels,	each @	7.00	1 glue pot,	@	.60
1 grindstone,	@	12.00	2 lb. glue,	each @	.20
20 sloyd knives,	each @	.18	6 clamps,	each @	.75
20 whisk brooms	each @	.06	1 plumb level,	@	1.50

2. 15 % discount is allowed on the total cost of this equipment. Find the net cost. Make out a bill against the local school department for the above list.

3. Suppose when this bill is paid a further discount of 5 % is made. What will be the expense to the school department?

4. For the first year, expenses of maintenance for the above manual training room were as follows: instruction, $900; stock, $314.50; additional equipment, $16.40. If instruction is provided for 456 boys, find the average cost per pupil for maintenance.

5. From the total net cost of equipment (examples 1–3) calculate the average cost per pupil (456) for equipment.

6. Find the cost of 6 lathes at $67.50, with 20 % discount.

Written Exercise

388. 1. Find the cost for equipment of a cooking room for a class of girls at the prices given below :

4 long tables,	each @	$15.00	4 doz. steel knives	each @	$ .80
10 gas plates,	each @	.35	1 doz. silver knives, plated	@	3.00
1 gas range,	@	28.00	1 doz. silver forks, plated	@	3.50
1 coal range,	@	42.00	2 doz. measuring spoons,	each @	.10
120 sq. ft. zinc,	each @	.20	40 yards dish toweling,	each @	.12
1 porcelain sink,	@	15.00	2 doz. hand towels,	each @	.18
1 refrigerator,	@	20.00	20 large mixing spoons,	each @	.15
1 dining table,	@	21.00	20 large mixing bowls,	each @	.12
6 dining chairs,	each @	4.00	20 measuring cups,	each @	.15
1 set dishes,	@	33.00	10 rolling pins,	each @	.16
1 set dishes,	@	9.00	10 bread boards,	each @	.25
50 large iron spoons,	each @	.08	1 boiler,	@	.35
50 small iron spoons,	each @	.05	4 large dish pans,	each @	.38
100 iron teaspoons,	each @	.03			

2. A discount of $12\frac{1}{2}\%$ is allowed upon the above. What is the net cost? Make out a bill against the local school department for all the dishes on the above list.

3. Suppose the above goods were bought on three months' credit, that is, with the agreement that they were to be paid for three months after the date of the purchase, but that 10% further discount was allowed for cash, that is, for immediate payment. How much would they cost the school department?

Make out and receipt bills against the school department of your municipality with discounts of $12\frac{1}{2}\%$ and 10% :

4. For the items of wooden ware of the above list.

5. For the items of hardware, tin, and cutlery included.

6. For all the items not included in above bills.

Written Exercise

389. **1.** The approximate value of the corn raised annually in the United States is $854,000,000. If this is 75% of the world's supply, what is the total world's supply?

2. Approximately 625,000,000 bu. of wheat are raised yearly in the United States. Of this Minnesota raises 11%. How many bushels does Minnesota raise?

3. In 1900 Wisconsin produced 10% of the oat crop in the United States, or 70,000,000 bushels. What was the total crop of the United States?

4. Reckoning the population of the United States at 80,000,000, how much sugar is consumed yearly in the entire country, if the annual consumption averages 70 lb. to each person?

5. The product of tobacco in the United States averages 408,000 tons annually. This is 37% of the whole world's crop. What is the total world's crop?

6. Of the United States cotton crop of approximately 10,000,000 bales each year, Texas produces 26%. How much does Texas produce? Georgia produces 14%. How much does Georgia produce?

7. Montana, Wyoming, and New Mexico have 32% of all the sheep in the United States. The total number in the United States is 62,000,000. How many have these three states?

8. Of eggs, 1,293,662,433 dozens were produced in the United States in 1900. All but 10% of this product were consumed in this country. How many dozens were used here? Find the average number consumed by a person if the population was 80,000,000.

Written Exercise

390. **1.** The gold produced in the United States in one year was valued at $80,000,000; the silver at $32,000,000. What was their combined value?

2. The total tonnage of the United States merchant marine for 1904 was 6,300,000 tons, of which 5,335,000 tons was in coastwise trade, 889,000 in foreign trade, and the remainder in whale and sea fisheries. What was the tonnage in whale and sea fisheries? What per cent of the total was this?

3. The amount of tonnage of all nations that entered and cleared in United States ports in 1903 was 49,500,000 tons, of which Atlantic ports received 62%. What tonnage did Atlantic ports receive? What did other ports receive?

4. The foreign commerce of the United States is approximately $30 per person. What is the total if the population is 80,000,000?

5. In Cuba there are 36 people per square mile. The area is 44,000 square miles. Find the total population.

6. Porto Rico has a population of 953,000 and an area of 3500 square miles. How many people has it per square mile?

7. There are 77,000,000 acres in Great Britain, of which 48 per cent are cultivated, 30 per cent are grazing lands, and the remainder is occupied by roads, forests, and parks. What number of acres is under cultivation? What number is used for grazing? What number for other purposes?

8. Statistics show that the total amount of coffee imported into the United States from Brazil during the year ending June, 1906, was 623,307,861 pounds, the value of which was $50,943,433. What was the value per pound?

Written Exercise

391. 1. What is the difference in area between 95 square feet and 95 feet square?

2. A house valued at $2000 is insured for $\frac{3}{5}$ of its value at $\frac{2}{3}$ per cent for 3 years. What is the premium?

3. What is the length of the base of a triangle whose altitude is 1 ft. 6 in., and whose area is 7 sq. ft. 6 sq. in.?

4. My taxes last year were $12.60 on a thousand. This year they are $16\frac{2}{3}\%$ higher. What will be my tax on $13,500 this year?

5. Suppose a deduction of 2% is made on a tax rate of $16.60 per $1000, what will remain to be paid on a property taxed for $8750?

6. Mr. Abram owed Mr. Benjamin $10,000. He gave Mr. Benjamin his written promise to pay it 2 months after Aug. 7, 1905. By paying interest to a bank for 63 days at the rate of 6%, and giving to the bank the note for security, Mr. Benjamin got the money Aug. 7, 1905. How much interest did he pay?

7. A young robin is known to have eaten 80 large-sized angleworms in a day. If these weighed 4 oz. and the robin weighed 6 oz., what per cent of his own weight did he eat?

8. The Continental areas are as follows: Europe, 3,800,000 sq. mi.; Asia, 17,000,000 sq. mi.; Africa, 11,500,000 sq. mi.; North America, 9,000,000 sq. mi.; South America, 7,000,000 sq. mi.; Australia, 3,000,000 sq. mi. Find the total area.

9. A block of oak weighing 85 pounds gained 40 pounds in weight after soaking in water one week. What per cent did it gain in weight?

Oral and Sight Exercise

392. 1. What is the right-hand figure of the sum when 9 is added to a number ending in 1? 2? 3? 4? 5? 6? 7? 8? 9?

2. Add at sight $116 + 9$; $234 + 9$; $275 + 9$; $177 + 9$; $138 + 9$.

3. What is the right-hand figure of the remainder when 9 is subtracted from a number ending in 1? 2? 3? 4? 5? 6? 7? 8? 9?

4. Subtract at sight $138 - 9$; $257 - 9$; $184 - 9$; $176 - 9$.

5. Give the product of 11 multiplied by itself.

393. The product of a number multiplied by itself is called the **square** of the number.

6. Give the square of each of the 9 digits. Give the square inches in 1 sq. ft.; the square feet in 1 sq. yd.

Written Exercise

394. Find the square of each of the following:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	15	45	65	25	42	35	13	30.5
2.	57	64	39	82	91	53	66	87.5

3. In 6 rods there are how many feet? yards?

4. In 150,000 lb. there are how many tons?

5. In 1 day there are how many minutes?

6. How many acres are there in a piece of land 4 miles square?

7. In 1 mile there are how many inches?

8. Divide 475,683 by 92; 264,121 by 2101.

9. A lawn is 72 feet by 46 feet. The land cost 78¢ a square foot and the fence around it cost 92¢ a foot. Find the entire cost.

Oral and Sight Exercise

395. 1. If 1 ton of coal occupies 30 cu. ft., how many tons are contained in a bin 8 ft. × 4 ft. × 3 ft.?

2. Yellow brass contains 2 parts of copper to 1 of zinc. How much copper must be put with 50 pounds of zinc to make yellow brass?

3. When $12\frac{1}{2}$ bushels of wheat are sold for \$10, what is the value of $37\frac{1}{2}$ bushels?

4. When a bolt of silk containing 48 yards is bought for \$72, what is the price per yard?

5. For what price must it be sold to double the money it cost?

6. If 4 cords of wood cost \$32, what is the cost of 10 cords?

Written Exercise

396. 1. The cost of provisions for a cruiser carrying 250 men is \$20,000 for 8 months. What is the cost per man?

2. Find the weight of a column of marble 18 ft. long, 1 ft. 6 in. square, the weight per cubic foot being 192 lb.

3. Find the weight of a column of granite of the above size, if granite weighs 240 lb. per cubic foot.

4. What is the amount of the pay roll for a gang of 70 laborers for 28 days, of 9 hours each, at $17\frac{1}{2}$¢ per hour?

5. A plank 24 ft. long, 15 in. wide, and 2 in. thick weighed 3240 lb. What was the weight per cubic foot?

6. A charge of \$18.75 is made by a broker for buying 100 shares of stock. If his commission was $\frac{1}{4}$%, what was the cost of the stock per share?

7. Multiply 37 by 3 and the successive multiples of 3 to 27, and find the sum of the products.

Oral and Sight Exercise

397. 1. $3.50 paid for a damaged mirror is 20% of its original cost. What was its original cost?

2. What is the cost of sawing a cord of wood, each stick being cut into 4 pieces, at 50¢ a cut?

3. If it cost $1.50 to saw a cord of 4 ft. wood into pieces 1 ft. long, how much would it cost to saw it into pieces 2 ft. long?

4. If 5 cords of wood cost $20, what is the cost of $2\frac{1}{2}$ cords? of $7\frac{1}{2}$ cords? of $6\frac{1}{4}$ cords?

5. I buy apples at the rate of 4 for 5 cents. For how much must I sell them apiece to gain 20%?

6. In a bin that measures 3 ft. by 3 ft. by 3 ft. there are how many cubic yards?

Written Exercise

398. 1. Find the weight of a bar of steel 11 ft. long, 8 in. wide, 4 in. thick, the weight per cubic foot being 432 lb.

2. How many gallons of water will fill a reservoir 60 ft. long, 16 ft. deep, and 32 ft. wide, a gallon occupying 231 cu. in.?

3. Find the cost of lining the above cistern, example 2, at $1.22\frac{1}{2}$ per square yard.

4. Find the value of 6250 tons of iron at $47.50 per ton.

5. What is the total cost of 45 bolts of silk, each 60 yards, purchased in Florence at $1.20 per yard, and upon which is paid a duty of 25%?

6. How many square feet can be paved with 24,000 tiles, each 8 in. by 10 in. in size?

Oral and Sight Exercise

399. 1. What is the difference in square inches between 8 sq. in. and an 8-inch square?

2. What is the difference in area between a floor containing 30 sq. ft. and a floor 30 ft. square?

3. If a floor containing 60 sq. ft. is 5 ft. wide, how long is it?

4. How long must a floor 5 ft. wide be to contain as many square feet as a floor 30 ft. square?

5. Goods bought for $10 are sold for $12. What per cent is gained?

6. $300 is what part of $900? What per cent is it?

Written Exercise

400. 1. $19.80 is 27% of a certain sum. What is 55% of the sum?

2. A field of rectangular shape contains 37.5 acres. It is 78.125 rods long. What is its width?

3. A yield of 900 bushels of wheat is secured from 25 acres. At the same rate, how many bushels should be obtained from 40.25 acres?

4. Find the cost of 14,062½ feet of lumber at $38.50 per M ft.

5. At the rate of 56 miles per hour, what distance can an express train cover in 5 hours 45 minutes?

6. What is the cost for the labor, at $3.50 each man per day, of laying 9 floors, each of which takes 2 men 2½ days?

7. What is the gain or loss on 2¼ acres of land bought at $6.40 an acre and sold at 1½¢ a square foot?

Oral and Sight Exercise

401. 1. 30 yards of carpet 1 yard wide will cover as much floor space as what number of yards of Brussels carpet $\frac{3}{4}$ yard wide?

2. 7 oranges are bought at 3 cents apiece and sold for 28 cents. What is the gain per cent?

3. A square room contains $7\frac{1}{9}$ sq. yd. How many yards is it around it?

4. The market price on a share of stock which was worth \$100 yesterday is $\frac{1}{2}$ % lower to-day. How much is it worth to-day?

5. $\frac{1}{2}$ of $\frac{1}{4}$ of a number is what per cent of it?

6. If a box 4 ft. long and 3 ft. wide contains 132 cu. ft., what is its depth?

Written Exercise

402. 1. Find the cost of paving a street $\frac{3}{4}$ mile long and 50 feet wide at \$4.50 per square yard.

2. What is the value of 250 sheep at \$4.38 apiece?

3. Find the value of 38 tons of hay at \$16.90 per ton.

4. The taxable property of the town of L—— is assessed for \$625,000. What is the total tax raised at the rate of \$14 on a thousand dollars?

5. What is the tax on an estate assessed at \$7680 at \$16.50 on a thousand dollars?

6. When on a capital stock of \$650,000 an insurance company declares a dividend of $3\frac{1}{2}$ %, what amount does a person receive who owns \$55,000 worth of the stock?

Oral and Sight Exercise

403. 1. What is $33\frac{1}{3}\%$ of \$108?

2. What is $\frac{5}{8}\%$ of 56 lb.?

3. Into how many pieces can a strip of cloth which is $3\frac{3}{4}$ yd. long be cut if the pieces are $\frac{3}{4}$ yd. long?

4. What is the area of a triangle if the base is 8 in. and the height is 12 in.?

5. If a pole 80 ft. long casts a shadow $2\frac{1}{2}\%$ of its length, what is the length of the shadow?

6. What per cent of 50% of 75 is $\frac{3}{8}$ of 100?

Written Exercise

404. 1. In 728 sq. rd. there are how many square feet?

2. There are how many square miles in a forest reserve containing 3,588,903 acres?

3. A factory building, 5 stories high above the basement, 150 feet long and 69 feet wide, has how many square yards of floor space, including the basement floor?

4. Make the proper rulings and enter the following items as they should appear in the account books of H. S. Van Deusen. Also make out a bill for the goods.

H. C. Atwell & Co. bought of H. S. Van Deusen, June 16, 1908, 4 bbl. of sugar containing 856 lb. at 4¢; 20 bbl. St. Louis flour at \$5.20; 13 chests Formosa Oolong tea at \$18.75; 35 lb. Rio coffee at 24¢.

5. From a tree 42 ft. 9 in. tall, $25\frac{5}{12}$ ft. of the top was broken off in a gale. What was the height of the part remaining?

Oral and Sight Exercise

405. 1. A girl had 90¢ to buy 2 pictures; one picture cost $\frac{4}{5}$ as much as the other. Find the cost of each.

2. Find the cost of $2\frac{1}{2}$ bu. of wheat at $1.50 a bushel.

3. $\frac{8}{9}$ of 72 is how many times 16?

4. A man sold a carriage at a gain of $104, which was 13% of its cost. Find the cost.

5. A boy's wages were $75 a month, but his board was $33\frac{1}{3}$% of this, and he spent $25 besides. How much did he have left out of his month's wages after deducting his board and other expenses?

6. $37\frac{1}{2}$ hundredths is what per cent of $62\frac{1}{2}$%?

Written Exercise

406. 1. In $5\frac{1}{4}$ miles there are how many yards?

2. The polar diameter of the earth is 7899.58 miles. This is equal to how many feet?

3. Brooklyn Bridge with extensions has a total length of 7580 ft. This is equal to a mile and what decimal of a mile?

4. At $1.20 per cubic yard, how much will it cost to excavate a cellar 140 ft. by 55 ft. by $11\frac{1}{2}$ ft.?

5. How many books, each containing 320 pages, $7\frac{1}{2}$ in. wide by 11 in. long, can be printed from 600 reams of paper (48 sheets to a ream), each sheet being 30 in. × 45 in.?

6. What will be the cost of lining a tank 8 feet long, 5 feet wide, and 6 feet deep with lead weighing $3\frac{1}{2}$ pounds to a square foot, at 10¢ a pound?

7. How many gallons of water will the tank (example 6) contain?

Oral and Sight Exercise

407. 1. What I buy for 8¢ and sell at a gain of 150% brings how much?

2. $\frac{3}{4}$ of my money is \$900. What is 50% of it?

3. What is an agent's commission at $2\frac{1}{2}$% for selling 500 pairs of shoes at \$2.00 a pair?

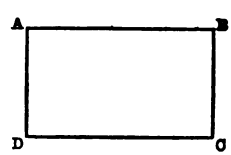
4. A man bought a cottage for \$640 and sold it at a loss of $37\frac{1}{2}$%. What was the selling price and the loss in money?

5. Find the cost of a pile of wood 8 ft. high, 4 ft. wide, 10 ft. long, at \$6.00 a cord.

6. A dividend is $\frac{5}{6}$; the divisor is $\frac{2}{3}$. Find the quotient.

Written Exercise

408. 1. *ABCD* represents a rectangle 432 ft. wide and $725\frac{3}{8}$ ft. long. What is the difference between the length and width?



2. How many square yards are there in a rectangle of the dimensions given in example 1 above?

3. A farm contained 306.06 acres of land. 41.566 acres were sold. How much remained?

4. The area of Norway is 124,122 square miles and the population is 2,222,000. What is the number of persons per square mile?

5. The area of Sweden is 172,920 square miles. Its population is 5,136,000. Its area, population, and the number of persons per square mile are how much greater than the area, population, and number of persons per square mile for Norway?

Oral and Sight Exercise

409. 1. Multiply one hundred by one hundred, and divide the product by ten, using the fewest figures possible.

2. Divide $\frac{3}{4}$ of $\frac{4}{5}$ by $\frac{4}{5}$ of $\frac{3}{4}$, with the least work possible.

3. If you start at your house at 12 o'clock, and walk at the rate of 2 miles an hour, and your brother starts at 1 o'clock, and walks after you at the rate of 3 miles an hour, in how many hours will he overtake you? How many miles will you then be from home?

4. If you have 18 cents and spend $\frac{1}{3}$ of half of it for dates, and the rest of it for 2-cent rolls, how many rolls do you get?

5. How many tiles, each 3 inches by 3 inches, will cover 2 square feet?

6. What is the per cent gained on a 50-cent article by selling it at $66\frac{2}{3}$ cents?

Written Exercise

410. 1. From 4 8 6, 3 6 2, 9 1 1, 9 6 0, 3 5 1, 2 3 4
Subtract 1 9 9, 6 3 2, 9 4 9, 8 7 1, 6 6 1, 4 9 6

2. I bought 75 shoats at \$3.25 apiece and sold $\frac{3}{5}$ of them at \$6 apiece, and the remainder at \$7 apiece. What per cent did I gain?

3. On a loan of \$470 made Feb. 4, 1906, interest being 5%, what is due (principal and interest) Aug. 20, 1907?

4. What will be the cost of fencing a railroad on both sides, $3\frac{1}{4}$ miles long, at \$1.45 a rod?

5. A rectangular block of stone contains 1200 cu. ft. It is 15 ft. long and 10 ft. wide. How thick is it?

Oral and Sight Exercise

411. 1. How will the product compare with the multiplicand when the multiplier is 1? when it is greater than 1? less than 1?

2. How will the quotient compare with the dividend when the divisor is 1? when the divisor is greater than 1? when it is less than 1?

3. Give instantly 7×8; 6×9; $\frac{1}{8}$ of 56; $\frac{1}{6}$ of 54; $56 \div 7$.

4. What is the per cent of gain made by buying oranges at 15¢ a dozen and selling them at 2 for 3¢?

5. You start at your house at 8 o'clock and walk 3 miles an hour. Your brother starts at 8:30 o'clock after you and walks 4 miles an hour. In how many hours after he starts will he overtake you? How far will you be from home?

6. A boy had 60 cents. He spent $\frac{1}{3}$ of his money for figs, $\frac{1}{2}$ of what he had left for raisins; $\frac{1}{4}$ of what he then had he gave to his sister; with the remainder he bought peanuts at 10 cents a quart. How many quarts did he buy?

Written Exercise

412. 1. Multiply one thousand one by one thousand, and divide the product by 100, using the fewest figures possible.

2. Measure off upon paper an area containing 12 square inches. Inclose by straight lines $\frac{1}{3}$ of $\frac{1}{2}$ this area. Put a little cross in the middle of this area.

3. How many bricks set up edgewise, each 8 in. by 2 in., will lay a walk 4 ft. wide and 20 ft. long?

Oral and Sight Exercise

413. 1. Add $\frac{3}{8}$ to .125, and subtract the sum from .7.

2. I bought stock for $300 and sold it for $250. What was my loss per cent?

3. What part of $5\frac{1}{2}$ days are $1\frac{3}{8}$ days?

4. If 5 men can do a piece of work in 4 days, how long will it take 3 men to do the same piece of work?

5. A man sold a cow for $108 at a loss of 10%. Find its cost.

6. I bought a rug for $50 and sold it at a gain of 40%. What was the selling price? the gain in money?

Written Exercise

414. 1.

From A to B is $105\frac{3}{4}$ ft.; from A to C is $14\frac{1}{2}$ ft.; from D to B is $14\frac{1}{2}$ ft. How far is it from C to D?

2. A bicyclist sets out on a journey of $24\frac{5}{8}$ miles. He rides $\frac{3}{4}$ of a mile the first hour, $3\frac{1}{6}$ miles the second hour, $5\frac{1}{2}$ miles the third hour, $4\frac{7}{8}$ miles the fourth hour, $7\frac{1}{4}$ miles the fifth hour. How far must he ride to complete the journey?

3. The area of New York State is 49,204 square miles. This is how much more than the area of Ohio, which has 41,040 square miles?

4. 994 is $33\frac{1}{3}$% of what number? $116\frac{2}{3}$% of what number?

5. A walk 40 feet long, $4\frac{1}{2}$ feet wide, is laid with bricks 4 in. by 2 in. by 8 in. How many bricks set on edge will it take to lay the whole walk? How many if laid flat? if set on end?

Oral and Sight Exercise

415. 1. An estate is valued at $2500. The house is worth $\frac{2}{3}$ as much as the land. What is the value of the house? of the land?

2. $\frac{2}{5}$ of 20 is what part of $7 \times 6 - 2$?

3. How many square inches are there on the upper and under surfaces of a box 7 inches long, 3 inches deep, and 4 inches wide?

4. $37\frac{1}{2}\%$ of 24 is what per cent of 54?

5. If a man who owned $\frac{3}{8}$ of a ship sold $\frac{1}{2}$ of $\frac{3}{8}$ of his share, how much of the ship did he still own?

6. Find the cost of 1 dozen pencils at $8\frac{1}{3}¢$ each.

Written Exercise

416. 1. Find the cost of 1,550,000 yards of sheeting, sold at $4\frac{1}{4}¢$ per yard.

2. What is $\frac{5}{8}$ of 1000? What is $\frac{3}{4}$ of 11,000?

3. A plate-glass window 8 ft. $\times$ 6 ft. costs $55. How much is that per square foot?

4. From a pole 7 ft. long, 20% is cut. How long is the remaining part?

5. 14 bbl. of apples were bought for $35.40. What should be paid for 1.5 bbl. at the same rate?

6. What is the value of 250 sheep at $4.28 apiece?

7. What are the wages for 32 men for 40 days of 8 hours each at 35¢ per hour? What are the wages of 24 women for the same time at a rate of 25% less than that of the men? How much does each woman receive?

Oral and Sight Exercise

417. 1. I bought a rug for $50 and sold it at a gain of $33\frac{1}{3}\%$. What was the selling price and the gain in money?

2. $18\frac{3}{4}\%$ of 80 is how many times $1\frac{1}{4}$?

3. Find the interest on $1 for 2 yr. 6 mo. at 8 %.

4. A man owning $\frac{5}{6}$ of an estate sold $\frac{4}{5}$ of $\frac{5}{6}$ of what he owned. What part of the estate had he left?

5. How many square inches are there on the surface of a box measuring $\frac{1}{3}$ of a yard on each edge?

6. 4×3 is what part of $\frac{3}{4}$ of 64?

Written Exercise

418. 1. Write in figures and add four hundred two and three tenths, two hundred and four thousandths, forty-three hundredths, and five thousand six.

2. A commission merchant made sales for me amounting to $1135. His commission at $2\frac{1}{2}\%$ was how much, and what were my net receipts, allowing $4.20 charges and $22.40 freight?

3. Tea which is bought for 28¢ a pound is sold for 38¢. What is the per cent of profit?

4. The net cost of a typewriter bought at 40 % and 5 % off is $95.50. What is the list price?

5. Find the gain on an article that is bought at $73 and sold for $85.50, deducting $\frac{1}{8}\%$ for buying and $\frac{1}{8}\%$ for selling.

6. How many sheets of cardboard, each 18 in. $\times$ 24 in., are needed to cut into 1200 cards 3 in. $\times$ 4 in.?

7. How many rolls of paper, each 320 yd. long and 4 ft. wide, are needed for 10,000 newspapers of 12 pages, 18 in. $\times$ 4 in.?

Oral and Sight Exercise

419. 1. Find $\frac{3}{4}$ of $\frac{4}{5}$ and give the product in a decimal.

2. A farm and barn are valued at $4500. The barn is worth $\frac{4}{5}$ as much as the land. What is the value of each?

3. What per cent of a bushel are 8 quarts?

4. If sixty-six and two thirds per cent of a number is twelve and one half, what is the number?

5. I bought a sleigh for $64 and sold it at a gain of $37\frac{1}{2}\%$. What was the selling price?

6. What is the interest of $600 for 2 yr. 1 mo. at 8 %?

Written Exercise

420. 1. From 7001 take 67.598.

2. $762{,}085 + 7 + 6085 + 2993 + 76 = ?$

3. Divide 7.239×670 by .63.

4. For how much does Mr. Ellis sell $204\frac{7}{8}$ acres of land if he gets $64\frac{1}{2}$ per acre?

5. What is the interest on $2000 from Sept. 1, 1907, to Oct. 16, 1909, at 6 %?

6. What is the interest on $52.24 for 5 yr. 10 mo. 1 da. at 3 %?

7. What is the volume of a rectangular block of stone $3\frac{3}{8}$ ft. $\times$ $2\frac{1}{5}$ ft. $\times$ $6\frac{1}{2}$ ft.?

8. A merchant received 720 barrels of flour, of which $16\frac{2}{3}\%$ were spoiled. How many barrels could he sell, and how much would he receive for it at $7\frac{3}{4}$ per barrel?

Oral and Sight Exercise

421. 1. Add $\frac{3}{8} + \frac{2}{8} + \frac{5}{8}$, and subtract $\frac{7}{8}$ from the sum.

2. A tank contains 360 cu. ft. It is 15 ft. long and 8 ft. wide. How deep is it?

3. A newsboy pays $\frac{4}{5}$ of a cent each for papers. How many papers can he buy for 20 cents? At 2¢ apiece, how much will the lot sell for?

4. A house and barn are worth $5500. The house is worth 10 times as much as the barn. What is the value of each?

5. How many square yards are there in the ceiling of a room 15 ft. long and 12 ft. wide?

6. A merchant buys goods amounting to $120. For how much must he sell them to gain 40%?

Written Exercise

422. 1. What will be the quotient of 826.4×700 divided by 1000?

2. From 6800 take 478.932.

3. If $8\frac{2}{3}$ yd. of cloth cost $20.50, how much must be paid for 12 yd.?

4. Find the cost of a field 64 rd. long and 32 rd. wide at $55.25 an acre.

5. What is the cost of goods that sell for $240 at a gain of 25%?

6. Mr. Waldron borrows $860 for 7 months and 24 days at 5%. What amount must he pay to cover both principal and interest?

Oral and Sight Exercise

423. 1. A sum of money on interest for 1 year at 4% gained \$32. What was the sum?

2. $\frac{5}{8}$ of \$24 is what per cent of $\frac{5}{8}$ of 36?

3. What is the cost of $9\frac{1}{3}$ yd. of cloth at $\$\frac{3}{5}$ a yard?

4. George is 12 years old, which is $\frac{2}{3}$ of $\frac{1}{3}$ of his father's age. How old is his father?

5. If I buy a cow for \$30 and sell it for \$40, what per cent do I gain?

6. A rectangular cistern contains 108 cu. ft. Two of its dimensions are 3 ft. and 4 ft. What is its third dimension?

Written Exercise

424. 1. Reduce to equivalent decimals $\frac{3}{16}$, $\frac{14}{15}$, $21\frac{9}{12}$, $15\frac{7}{8}$, $\frac{1}{125}$.

2. A bin 18 feet long and 9 feet deep must be how wide to contain 40 tons of coal, allowing 30 cubic feet to the ton?

3. What is the interest on \$375.75 for $5\frac{1}{2}$ years at 8%?

4. What is the interest on \$1400 for 3 yr. 7 mo. at $5\frac{1}{2}$%?

5. If $\$283.33\frac{1}{3}$ is the interest for 2 years 10 months on \$2500, what is the rate?

6. John Bennet loans to T. C. Brown on June 24, 1908, \$340 at 5% interest. If Brown settles the loan on April 24, 1910, how much does he pay?

7. Estimate the cost of building a granite breakwater 18,000 ft. long, 18 ft. high, and 9 ft. thick, if the granite costs \$4.10 per cubic yard delivered, the labor amounts to 150 days for 144 men working 9 hours a day at 35¢ an hour, and the engineering costs 5% of the cost of material and labor.

Oral and Sight Exercise

425. 1. $\frac{1}{5}$ of an estate was given to a charitable institution. The remainder was divided equally among four children. What part did each get?

2. What is the interest of $400 for 2 years 1 month at 6%?

3. Considering the circumference of a circle to be $3\frac{1}{7}$ times its diameter, what is the distance around a pail whose diameter is 14 inches?

4. Express $\frac{1}{2}\%$ in the form of a common fraction.

5. Express $\frac{3}{4}\%$ in the form of a decimal.

6. Give in other denominations: $\frac{1}{3}$ yd.; $\frac{1}{3}$ ft.; $\frac{1}{3}$ da.; $\frac{1}{3}$ min.

Written Exercise

426. 1. Add 23.6, 1.155, .0005, .99, .3.

2. From 33.9375 take 12.0856.

3. Find the value of 2460 lb. beans at $2.25 per bushel (60 lb. to the bushel), 4480 lb. buckwheat at 88¢ per bushel (48 lb. to the bushel), 2240 lb. wheat at 98¢ per bushel (60 lb. to the bushel).

4. Multiply 13.0565 by .04, and divide the product by 1000.

5. Divide 46.15302 by 3.56.

6. The bricks in a building cost $2850 at $9.50 per M. How many bricks were purchased?

7. $\frac{2}{5}$ of a hogshead of molasses is worth $42. What is the value of $\frac{3}{8}$ of the remainder?

8. A milk dealer sells 23 qt. of milk daily at 9¢. If it costs him 5¢ a quart, what is his per cent of profit?

Oral and Sight Exercise

427. 1. What per cent of 1.6 is .5?

2. What number increased by 25% of itself equals 250?

3. Willie bought for 90¢ a pair of skates, which he sold for $1.20. What was his per cent of gain?

4. If $1\frac{1}{3}$ yd. of cloth cost $\frac{1}{4}$ of a dollar, how much will $6\frac{1}{3}$ yd. cost?

5. A box 4 ft. square contains 64 cu. ft. How deep is it?

6. 65 is $1\frac{1}{4}$ times what number?

Written Exercise

428. 1. Find the cost of plastering the schoolroom at 20¢ per square yard.

2. Find the cost of lumber in the schoolroom floor at $55 per thousand feet.

3. Find the cost of loam for covering a lawn 4 in. deep, at $2.25 per cubic yard, the lawn measuring 57 ft. by 34 ft.

4. What is the cost of a concrete walk 29 ft. long and 6 ft. wide at 24¢ per square foot?

5. If I buy gloves at $1.25 per pair and sell them for 1.62\frac{1}{2}$, what per cent do I gain?

6. Mr. Luce bought a wood lot and then sold it to Mr. Beals at a gain of 12$\frac{1}{2}$%. Mr. Beals sold it for $612 and lost 15%. How much did the lot cost Mr. Luce?

7. A quantity of soap in 48 lb. boxes is sold for $221.18 at 6.4¢ a pound. There are how many boxes?

Oral and Sight Exercise

429. 1. What per cent of a 2-inch square is a 1-inch square?

2. How many times will $\frac{7}{8}$ contain $\frac{1}{2}$ of $\frac{5}{16}$?

3. The base of a triangle is 6 ft., and its altitude 20 ft. What is the area?

4. I sent my agent $204 with which to buy flour. His commission of 2% on the purchase money being deducted, how many barrels at $5 each could he buy?

5. If 20 bbl. of potatoes at $4 a barrel are given for corn at 50¢ a bushel, how many bushels will be received?

6. $66\frac{2}{3}\%$ of a number is 40. What is the number?

Written Exercise

430. Subtract:

1. $632\frac{3}{5} - 61\frac{1}{5}$

2. $439\frac{5}{6} - 121\frac{7}{12}$

3. $809\frac{8}{11} - 78\frac{2}{3}$

4. What is the value of a pile of wood 50 ft. long, 12 ft. high, and 4 ft. wide at $6.50 per cord?

5. A contractor pays 28 men $2.75 per day. How much does he pay them each week?

6. What is the cost of 17 dozen eggs at $3\frac{1}{2}$ cents apiece?

7. Prince lives $\frac{2}{5}$ of a mile from the school. Earl lives $\frac{2}{3}$ of a mile from the school in the opposite direction. How many feet will Prince walk in going from his home to Earl's and back?

8. 200 bushels of apples packed in boxes holding 2 pk. 5 qt. each require how many boxes?

Oral and Sight Exercise

431. 1. What is the circumference of a circle whose diameter is $3\frac{1}{2}$ inches, the circumference being $3\frac{1}{7}$ times the diameter?

2. What is $\frac{5}{6}\%$ of 54 lb.?

3. What is $33\frac{1}{3}\%$ of $\frac{3}{10}$ of 200?

4. $\frac{1}{5}$ of 40 is what per cent of 80?

5. The area of a triangle whose height is 7 in. is 28 sq. in. What is the base?

6. How many cubic feet are there in a wall 20 ft. long, 10 ft. high, and 15 in. thick?

Written Exercise

432. 1. Multiply 7289.46 by 7.043, and divide the product by .001.

Find the least common multiple:

2. Of 2, 4, 3, 5, 15, 12, 14.

3. Of 48, 3, 10, 6, 8, 36, 24.

4. What is the total weight of 3 hogsheads of sugar weighing $416\frac{1}{4}$ lb., $478\frac{1}{2}$ lb., and $498\frac{3}{8}$ lb.?

5. At what price per barrel must a lot of 180 bbl. of flour be sold to gain 20%, if the lot cost \$864?

6. From a lot of 600 bushels of beets, $\frac{1}{4}$ were sold at one time, and $\frac{1}{5}$ at another. How much did the remainder sell for at 80 cents a bushel?

7. What is the total cost of cloth, yards and prices as follows:

4 yd. at $18\frac{3}{4}$¢?	50 yd. at 30¢?
32 yd. at \$1.10?	20 yd. at $8\frac{1}{3}$?
44 yd. at $37\frac{1}{2}$¢?	160 yd. at 25¢?

Oral and Sight Exercise

433. 1. Give in other denominations $\$\frac{1}{4}$; $\frac{1}{4}$ ft.; $\frac{1}{4}$ bu.

2. I bought $1\frac{1}{2}$ qt. cream at 30¢ and 6 oranges at 40¢ a dozen. Give the cost of both.

3. If $1\frac{1}{2}$ dozen eggs cost 30 cents, how much will 10 dozen cost?

4. If a horse eats 4 quarts of oats a day, how many days will 8 bushels last him?

5. At 6¢ a dozen, how many marbles can I buy for 50¢?

6. Fish hooks cost $\frac{1}{2}$¢ apiece. How many dozen will 60¢ buy?

Written Exercise

434. 1. How wide is a rectangular plot of land that contains 640 sq. rd. and is 660 ft. long?

2. If $2\frac{1}{2}$ dozen eggs cost a dollar, how much will 1500 dozen cost?

3. What is the interest on $\$875.50$ from Aug. 6, 1906, to Feb. 2, 1909, at 7%?

4. At the rate of 1 cent per square foot, what is the value of an acre of land?

5. I bought 220 bu. of corn at 40¢ a bushel and sold the lot for $\$121$. How much did I gain? What per cent?

6. Copy and add in columns $\$274.68$, $\$500$, $\$289.99$, $\$367.89$, $\$211.28$, $\$976.84$, $\$897.65$, $\$567.98$, $\$740.80$, $\$868.86$, $\$479.47$, $\$826.66$.

7. A wheel with a circumference of 10 feet will make how many more revolutions in going 1 mile than a wheel with a circumference of 6 feet? How many more revolutions will it make than a wheel with a circumference of 8 feet?

Oral and Sight Exercise

435. 1. At $66\frac{2}{3}¢$ a yard for brilliantine, how many yards can be bought for $22?

2. In a bin that measures $1\frac{1}{2}$ ft. by $1\frac{1}{2}$ ft. by $1\frac{1}{2}$ ft., there are how many cubic yards?

3. After spending .2 and .25 of my money, I had $55 left. How much had I at first?

4. What is the interest of $200 for 4 yr. 4 mo. at 3%?

5. At $4\frac{1}{5}$ a cord, how much will $\frac{3}{4}$ of a cord of wood cost?

6. $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of 24 is what per cent of 90?

Written Exercise

436. 1. Divide 11.984 by .34, and multiply the quotient by 100.

2. Change to decimals, and add $\frac{1}{2}$, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{11}{16}$.

3. My garden has an area of 1330 sq. ft. It is 38 ft. long. How wide is it?

4. I allow $\frac{3}{8}\%$ commission to an agent for selling my farm for $1250. How much money do I receive?

5. A boy pays $5.66 for 200 papers. He sells them at $4¢$ each. How much does he gain?

6. I sold goods at 22% profit and gained $55.50. What was the cost? the selling price?

7. If an acre of land is worth $37\frac{1}{2}$, what is the value of $\frac{3}{4}$ of an acre?

8. In a human body weighing 150 pounds, approximately 113 pounds are water. Water is what per cent of the total weight?

Oral and Sight Exercise

437. 1. What fraction of a year are 3 mo.? 4 mo.? 9 mo.? 8 mo.?

2. What fraction of a month (30 da.) are 6 da.? 10 da.? 12 da.?

3. If 1 yard of silk costs $\frac{5}{8}$ of a dollar, how many yards can be bought for $10?

Supply the missing numbers:

4. With a dime and 2 cents there can be bought 4 oranges at —— cents each, or 6 pencils at —— cents each, or 12 pens at —— cents each, or 8 lemons at —— cents each.

Supply the missing numbers:

5. From a stick 4 feet long there can be cut —— 4-inch sticks, or —— 6-inch sticks, or —— 12-inch sticks, or —— 8-inch sticks, or —— 16-inch sticks.

6. How must a hatter mark a hat that cost him $3.00 so as to sell it at 20% less than his marked price, and still make a profit of $16\frac{2}{3}$%?

Written Exercise

438. 1. How many barrels of pears at 3\frac{1}{3}$ a barrel will pay for 18 tons of hay at $16.50 a ton?

2. What is the total cost of $18\frac{1}{2}$ yards of cloth at 20¢? of 30 yd. at $16\frac{2}{3}$¢? of 20 yd. at $62\frac{1}{2}$¢?

3. If a vessel steams $123\frac{3}{4}$ miles in $9\frac{1}{3}$ hours, what is the rate per hour?

4. How long will it take the above vessel to steam 1000 miles at the same rate as above?

5. On a scale of $\frac{1}{2}$ inch to the foot make a diagram of a triangle having sides 3 feet, 4 feet, and 5 feet long. What kind of a triangle does it make?

Oral and Sight Exercise

439. 1. Trains leave Boston and arrive at Portland as follows:

Leave Boston	7:30 A.M.	8:30 A.M.	4:25 P.M.
Reach Portland	11:45 A.M.	12:05 P.M.	7:20 P.M.

How many hours and minutes is the first in going? the second? the third?

2. At $12\frac{1}{2}¢$ each, how many lamp chimneys can be bought for $\$1\frac{1}{2}$?

3. In how many years will the interest on a sum of money equal the principal at 1% a year? at 12% a year? at 6% a year?

4. 16 years 8 months equal how many months?

5. If the interest on a sum of money at 6% equals the principal in 200 months, in how many months will the interest equal $\frac{1}{10}$ of the principal?

6. Divide one thousand by one thousandth.

Written Exercise

440. 1. Find the prime factors of 775, 385.

2. $\$24.06$ is 3% of a sum of money at interest. Give the sum.

3. Find the interest on $\$1200$ for 2 yr. 3 mo. at 7%.

4. From a 4-acre lot two pieces of land are sold, — one 400 ft. $\times$ 300 ft., another 200 ft. $\times$ 100 ft. How many square feet remain?

5. There are how many square yards in the walls and ceiling of a schoolroom 32 ft. square and 11 ft. high?

6. A ranchman shears from a flock of 800 sheep an average of 5 pounds of wool to each sheep, which he sells for $21\frac{1}{2}¢$ per pound. What are his receipts for the wool?

Oral and Sight Exercise

441. 1. What is the interest on $50 for 1 yr. 8 mo. at 6%?

2. What is the amount of $80 on interest for 1 yr. 8 mo. at 6%?

3. What part of 16 yr. 8 mo. (200 mo.) are 2 mo.? What is the interest on $200 for 2 mo. at 6%?

4. Find the interest at 6% on $300 for 2 mo.; for 4 mo.; for 8 mo.

5. The interest of $600 for 10 mo. at 6% is $30. What would the interest be at 12%? at 3%?

6. Find the interest on $200 for 1 yr. 8 mo. at 3%.

Written Exercise

442. 1. Multiply:

8531	$2134\frac{7}{8}$	$5879\frac{3}{5}$
$\times 42\frac{5}{8}$	$\times 67$	$\times 89$

2. Multiply and prove:

279,753,962,845,348,261

$\times 6$

3. A cubic foot of cork weighs 15 pounds. What does a cubic inch weigh?

4. Find the total cost of 78 bbl. of flour at $5.40; 200 bbl. at $3.12\frac{1}{2}$; 40 bbl. at $5; 350 bbl. at $11.87\frac{1}{2}$, and 600 bbl. at $4.50.

5. 5 yards of cloth cost $15. How much will $16\frac{1}{4}$ yards cost?

6. Find the cost of covering a walk with asphalt at $1.25 a square yard, the walk being 5 feet wide and 180 feet long.

7. How many square feet and square inches are there in the top of a table $4\frac{1}{4}$ feet long and $3\frac{1}{3}$ feet wide?

Oral and Sight Exercise

443. 1. A sum of money on interest at 6% is said to double itself in 16 yr. 8 mo. (200 mo.). What part of the principal will the interest be at 6% for 100 mo.? for 50 mo.? for 25 mo.?

2. Give the interest on $400 at 6% for 4 yr. 2 mo.; for 2 yr. 1 mo.

3. Give the amount of $800 on interest at 6% for 4 yr. 2 mo.

4. If a note of $80 is on interest at 6% from April 1 to June 1 the same year, what will the interest be?

5. Find the interest on $500 from Jan. 1 to May 1 at 6%; at 3%.

6. Find the amount of $1000 on interest at 6% from June 15 to Dec. 15, 1908.

Written Exercise

444. 1. Divide:

$$5\overline{)14,382,531,664,614,259,421}$$

2. Add, and multiply each sum by 43; then add products:

59	668	799	886	725	052	861
99	668	897	776	334	651	766
66	453	627	289	875	443	619

3. Find the total of the above sums, and multiply it by 43.

4. In 1890 the population of the United States was 62,622,250. In 1900 it was 75,568,686. What was the increase? What was the per cent of increase?

Oral and Sight Exercise

445. 1. At 6% the interest is what part of the principal for 2 months (60 days)? What part of the principal will the interest be for 30 days? for 12 days? for 6 days?

2. Find the interest at 6% on $1200 for 60 days; for 6 days; for 66 days.

3. Find the amount of $1200 on interest at 6% for 36 days.

4. Find the amount of $2000 on interest at 6% for 15 days.

5. A note is given at a bank for $300, to be paid 4 months later. If the bank reserves the interest on the sum for 4 months at 6%, how much cash will the bank pay out?

6. Suppose the rate of interest was 4%, how much cash would the bank pay out on the above note?

Written Exercise

446. 1. A 10-acre field is 80 rods long. How wide is it?

2. Change these decimals to per cents:

$$.08, \quad 1.3, \quad .003\tfrac{1}{3}, \quad .275, \quad .2\tfrac{1}{4}$$

3. $640 \div .08 = ?$ $\quad .084 \div .07 = ?$

4. A cow giving 10 quarts of milk per day produces what income in a year of 360 days, if the milk is sold at 7¢ per quart? What profit is made, if its keep costs $124.50 for the year?

5. The provisions for a cruiser carrying a crew of 250 men cost $20,000 for a cruise of 8 months. What is the average cost per man?

6. What is the cost of carpeting for 150 hotel bedrooms, each 18 ft. by 15 ft., at $1.30 a square yard?

Oral and Sight Exercise

447. 1. Find the interest on $500 for 2 yr. 6 mo. at 6%.

2. What is the amount of $120 at 6% for 2 yr. 1 mo.?

3. Find the interest of $600 for 90 da. at 6%; at 3%.

4. What is the interest on $500 for 3 mo. at $\frac{1}{2}$% a month?

5. I pay interest at the rate of 6% on $200 of taxes overdue for 63 days. How much do I pay, including taxes overdue, and interest?

6. Find the interest on $250 at 6% from January 5 to the 11th of July following.

Written Exercise

448. 1. Which is the larger, a discount of 30% on $3000, or a discount of 20% and 10%? How much?

2. At a cost of 103.31\frac{1}{4}$ a rod, how many miles of road can be built for $30,000?

3. A merchant had two pieces of cloth of the same pattern and material, one containing 36$\frac{1}{2}$ yd., the other 43$\frac{7}{8}$ yd. He sold 14$\frac{3}{4}$ yd., 20$\frac{3}{8}$ yd., and 15$\frac{1}{2}$ yd. How much had he left?

4. How much will it cost to build the wall of a cellar 80 ft. long, 67 ft. wide, 9 ft. high, and 18 in. thick, at $2.00 a cubic yard?

5. A rectangular lawn 58 ft. by 32 ft. has a 4 ft. walk extending around it on the outside. How many square feet are there in the walk?

6. Mr. Kelley sold a horse that cost him $425 and $45 for its keep, at a gain of 15%. With the receipts he bought a runabout automobile. How much did he pay for it?

Written Exercise

449. 1. During a rainfall of 7 inches, how many gallons of water fall upon a platform 8 feet wide and 24 feet long?

2. The weight of a boy is 90 pounds. If he is 20 % heavier than his brother, how much do both brothers weigh together?

3. The elevation above sea level of the lake which is to form 26 miles of the Panama Canal is to be reached by 3 locks averaging 28⅓ feet in height. The top of the Gatun dam, which will form this lake, will rise 50 feet above the lake. What will be the height of the top of the dam above sea level?

4. The Gatun dam will contain approximately 22,000,000 cubic yards of earth. Suppose its average thickness to be ¼ mile and its height 135 feet, what will be its average length?

5. A broker gets money for me on my note for $2500, charging me a commission of ¼ % for his service. How much is his commission?

6. Compute the amount due each workman and the total amount of the pay roll in the following:

PAY ROLL

No.	Name	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total Hours	Rate	Amount
		h. m.	h. m.	h. m.	h. m.	h. m.	h. m.		per h.	
(1)	J. Shaw	8.10	8.10	8.00	8.20	8.30	7.30		.22½	
(2)	P. Miller	8.10	8.10	9.30	9.40	10.00	9.00		.22½	
(3)	C. H. Elson	8.30	8.30	9.00	9.00	10.00	9.00		.30	
(4)	Wm. Kuhn	10.00	10.00	10.00	9.40	9.30	7.30		.15	
(5)	R. P. Jackson	9.30	8.30	9.30	9.40	10.00	8.00		.16⅔	
(6)	C. C. Samuels	9.10	9.30	10.00	10.00	10.00	8.30		.12½	
(7)	F. H. Bailey	7.20	9.10	8.10	6.20	10.00	9.40		.15	
(8)	E. B. Harvey	8.40	9.30	9.30	9.30	9.30	6.00		.10	
(9)	C. T. Tibbetts	8.40	9.00	10.00	10.00	8.20	4.20		.12	
(10)	M. W. Mosely	10.00	10.00	10.00	10.00	10.00	5.00		.13½	
	Totals . . .									

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